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# ELEMENTS

# OF

# ANATOMY

# AND THE

# ANIMAL OECONOMY.

THE SECOND EDITION,

With conſiderable ALTERATIONS and ADDITIONS.

LONDON:
Printed for J. WALKER, Nº 20, Pater-noſter-Row.
MDCCLXXXI.

TO

# MR. ELSE,

SURGEON AND READER OF ANATOMY TO
ST. THOMAS's HOSPITAL IN LONDON;
AND
MEMBER OF THE ROYAL ACADEMY OF
SURGERY AT PARIS.

DEAR SIR,

I HAVE taken the Liberty to prefix your Name to the following Performance, and I wiſh it had been in my Power to have rendered it leſs unworthy your Acceptance. If it ſhould be found to merit the good Opinion of the

World, I ſhall impute my Succeſs to the Inſtruction I imbibed from your ingenious Lectures. I beg the Favour of you to receive it as a Teſtimony of my Reſpect, and as a trifling Acknowledgement of the many Civilities and Offices of Friendſhip with which you have been pleaſed to honour me. Believe me to be, with the ſincereſt Reſpect and Eſteem,

Dear Sir,

your obliged

humble Servant,

SAMUEL FOART SIMMONS.

Wingham in Kent,
Feb. 22, 1775.

# PREFACE.

IN the Preface to the firſt edition of this work, publiſhed in 1775, the editor acknowledged himſelf indebted for his plan and ſome part of his materials, to the *Elemens d'Anatomie Raiſonnée,* written by M. Perſon, an ingenious French phyſician, and originally publiſhed at Paris in 1748. The manner in which that performance was written, ſeemed to be well calculated for ſtudents; and at firſt it was the editor's intention to have given a literal tranſlation of it, with the addition of notes. But on examining it more attentively, a multitude of corrections and additions were found neceſſary to make it adequate to the purpoſe for which it was intended. It contained old and erroneous theories which have long been deſervedly exploded; many of the deſcriptions were inaccurate and imperfect; ſome parts of the body, as, for inſtance, the breaſts, and organs of generation, were wholly omitted; the nature of the lymphatic ſyſtem, and of abſorption, together with the many other diſcoveries and improvements that have been made in anatomy and phyſiology ſince the publication of M. Perſon's book, were of courſe not to be met with in it. Hence the reader will eaſily conceive, that the taſk of new modelling the work, ſo as to render it ſuitable to the preſent ſtate of anatomical knowledge, could fall but little ſhort of that of compoſing a new one; and that this was really the caſe, will be ſufficiently evident to any one who will be at the pains to compare the preſent performance with the French work juſt now mentioned. He will find the form retained, but the ſubſtance almoſt every where changed.

In this new edition, the editor has endeavoured to render the work more uſeful, by correcting the errors that had eſcaped him in the former impreſſion, and by making a great number of alterations and additions.

Air-Street, Piccadilly,
March 17, 1781.

*Lately publiſhed in* 8vo, Price Two Shillings.

PRACTICAL OBSERVATIONS

ON THE

TREATMENT OF CONSUMPTIONS.

By SAMUEL FOART SIMMONS, M. D.

Member of the Royal College of Phyſicians, London; and F. R. S.

Sold by J. MURRAY, Fleet-Street; J. WALKER, Pater-noſter-Row; and J. FISK, Edward Street, Portman-Square.

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## PLATE I.

| | |
|---|---|
| A. A. A. A. | The Globe of the Eye. |
| B. B. | The Vitreous Humour. |
| C. | The Cryſtalline Humour. |
| D. | The Aqueous Humour. |
| *e. e.* | The Anterior Chamber of the Eye. |
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The Object is ſeen inverted at the Bottom of the Eye, ſee page 416.

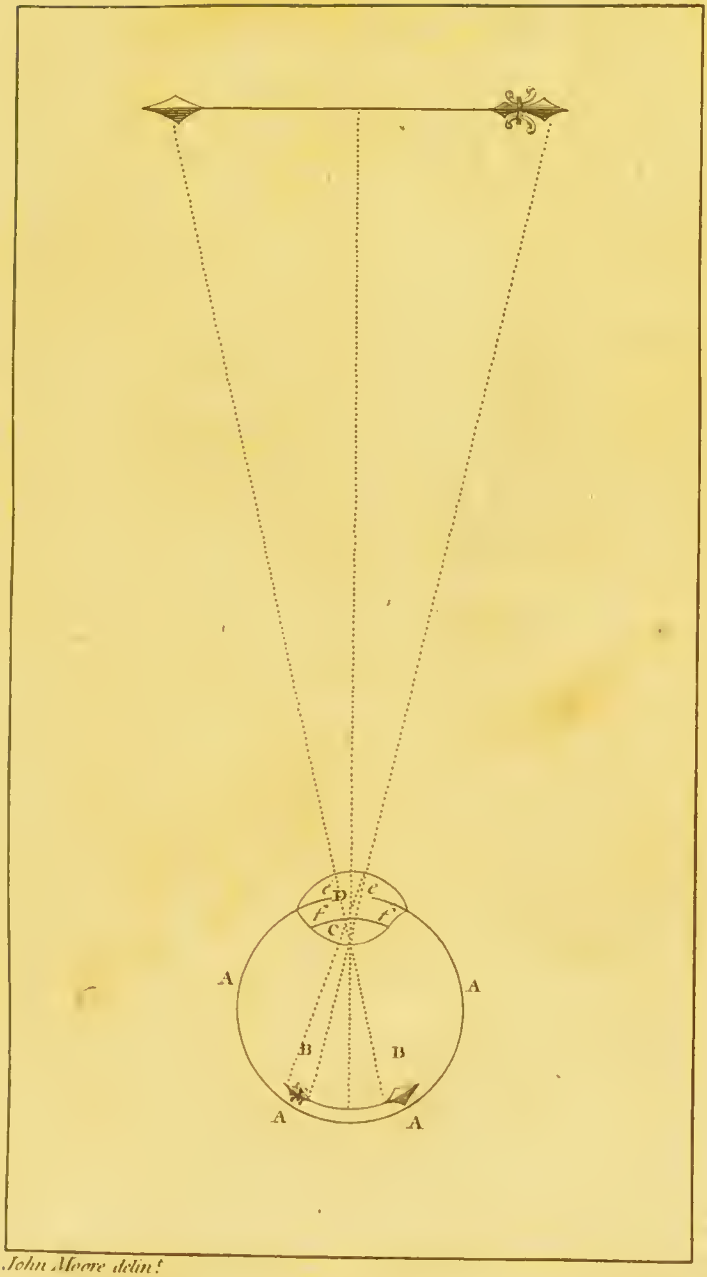
## PLATE II.

In this Plate the Rays of Light in Conſequence of too much Convexity in the Cornea, are ſeen to unite before they reach the Bottom of the Eye, as is the Caſe with near-ſighted People or *Myopes*, ſee page 417.

## PLATE III.

In this Plate, from the Eye's being too flat, the Rays of Light are not united when they reach the Bottom of the Eye, as is the Caſe with long-ſighted People or *Preſbi*, ſee page 417.

Plate I.



*John Moore delint*

Plate II.

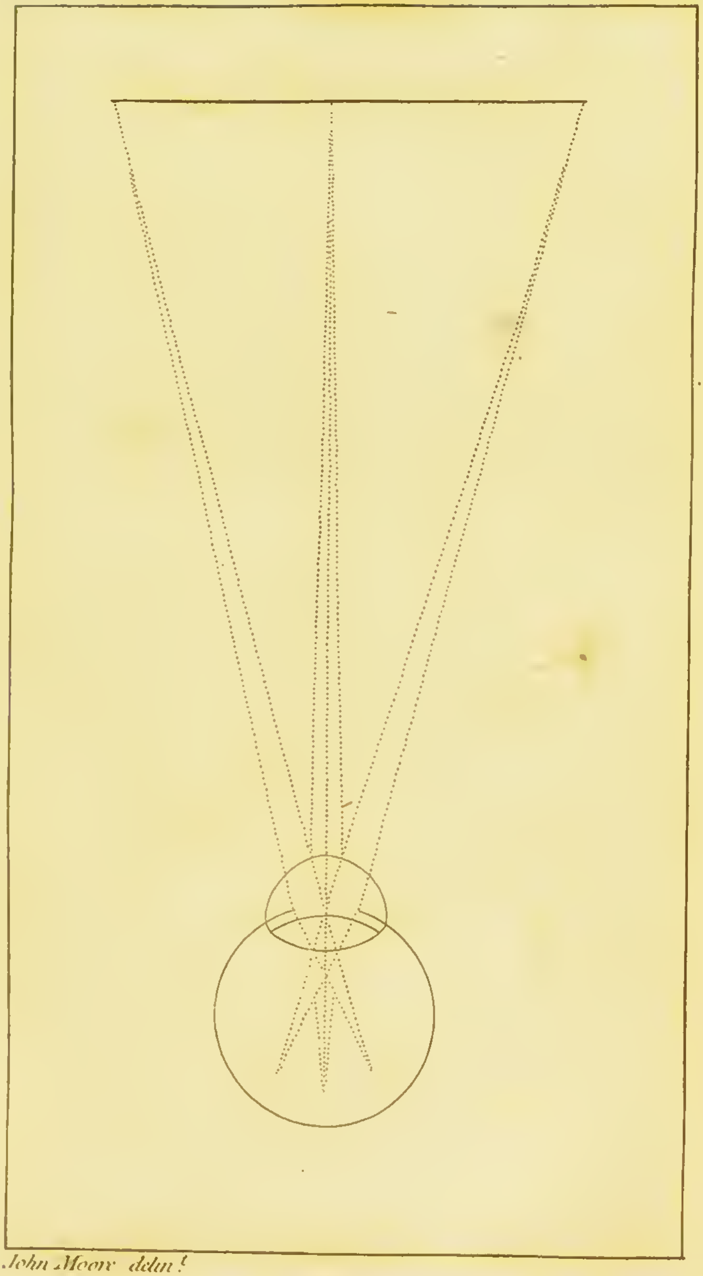


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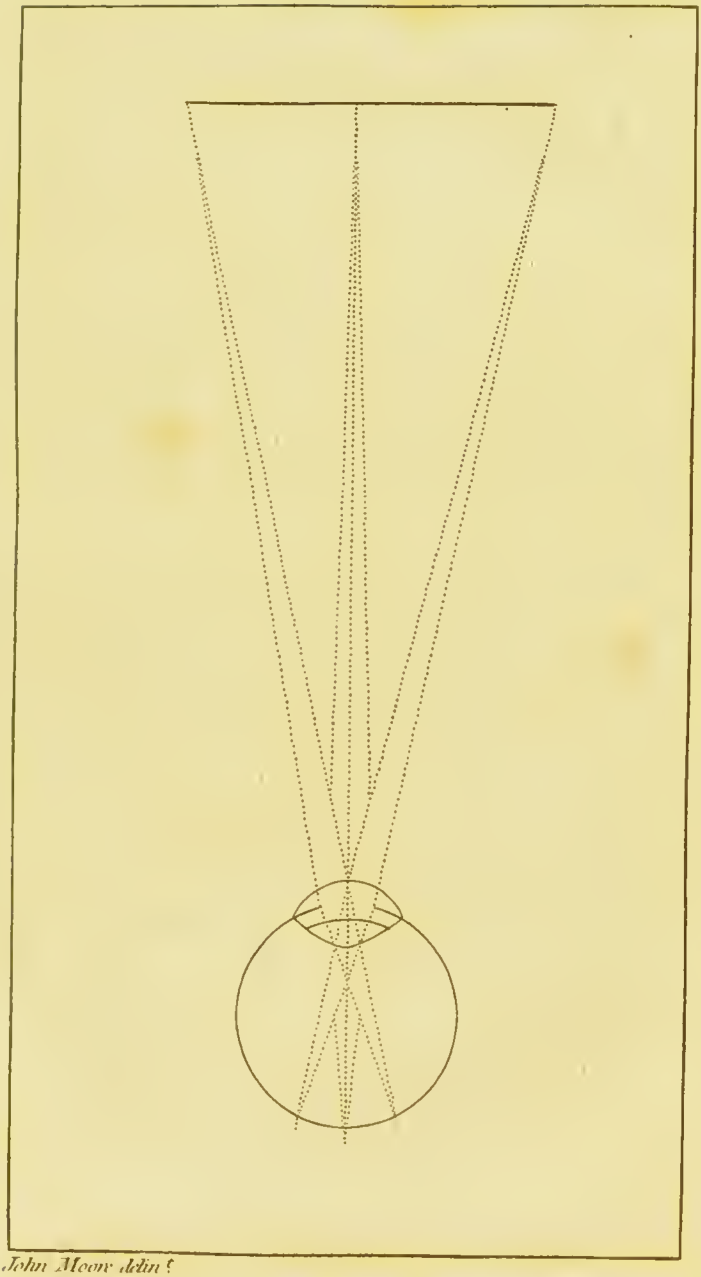
Plate III.



*John Moor delin^t*

# ELEMENTS

# OF

# ANATOMY, &c.

## INTRODUCTION.

THE etymology of the word Anatomy implies ſimply, diſſection, but by this term ſomething more is uſually underſtood.

It is every day made uſe of to expreſs a knowledge of the human body; and a perſon who is ſaid to underſtand Anatomy, is ſuppoſed to be converſant with the ſtructure and arrangement of the different ſolid parts of the body.

It is commonly divided into Anatomy properly ſo called, and comparative Anatomy; the firſt of theſe is confined ſolely to the human body, but the latter affords a more extenſive field for enquiry, as it includes all animals and even plants, ſo far as a knowledge of their ſtructure may tend to improve our ideas of the human body.

The word Anatomy may alſo have another and more extenſive ſignification—it may be employed to expreſs, not only a knowledge of the ſtructure and diſpoſition of the parts, but likewiſe of their œconomy and uſe—conſidered in this light, it will ſeldom fail to excite the curioſity of people of taſte, as a branch of philoſophy; ſince if it is pleaſing to be acquainted with the ſtructure of the body, it is certainly more ſo, to diſcover all the ſprings which give life and motion to the machine, and to obſerve the admirable mechaniſm by which ſo many different functions are executed.

THE human body is compoſed of ſolid and fluid parts.—We ſhall deſcribe each of theſe, and at the ſame time ſpeak of their reciprocal action upon each other. This is not common with the generality of anatomical writers, who uſually dwell but little on the animal œconomy which will form the principal part of this work.

ANATOMY, ſo far as it relates to the ſolids, is divided into ſeveral branches, diſtinguiſhed by different names, and alluding to the different parts they uſually deſcribe.—Thus the term

OSTEOLOGY, is allotted to a deſcription of the bones.

MYOLOGY, to that of the muſcles.

ANGEIOLOGY, to that of the veſſels.

NEUROLOGY, to that which treats of the nerves.

ADENOLOGY, to that which gives the hiſtory of the glands.

AND SPLANCHNOLOGY, to that which diſcourſes on the viſcera. All theſe terms are of Greek etymology.—It will be ſufficient, perhaps, for the reader to know their ſignification.

# CHAP. I.

# *OSTEOLOGY.*

## SECTION I.

## *Of the Bones in general.*

WE will begin with the bones, which may be conſidered as the great ſupport of the body, tending to give it ſhape and firmneſs.—But before we enter into the detail of each particular bone, it will be neceſſary to deſcribe their compoſition and connections, and to explain the nature of the different parts, which have an immediate relation to them; as the cartilages, ligaments, perioſteum, marrow and ſynovial glands.

### *Of the Compoſition of the Bones.*

THE bones are of a firm and hard (*a*) ſubſtance, of a white color, and perfectly inſenſible. They are the moſt compact and ſolid parts of the body, and ſerve for the attachment or ſupport of all the other parts.

(*a*) An ingenious Swediſh chemiſt, (Mr. Scheele) has lately diſcovered that the bones contain the phoſphoric acid united with calcareous earth; and that to this combination they owe their firmneſs.

THREE different ſubſtances are uſually diſtinguiſhed in them; their exterior or bony part, properly ſo called; their ſpongy cells, and their reticular ſubſtance. The firſt of theſe is formed of many laminæ, or plates, compoſing a firm, hard ſubſtance—The ſpongy or cellular part, is ſo called on account of its reſemblance to a ſponge, from the little cells which compoſe it. This ſubſtance forms almoſt the whole of the extremities of cylindrical bones—The reticular part is compoſed of fibres, which croſs each other in different directions—This net-work forms the internal ſurface of thoſe bones, which have cavities.

THE flat bones, as thoſe of the head, are compoſed only of the laminæ and the cellular ſubſtance—This laſt is uſually found in the middle of the bone dividing it into two plates, and is there called *diploe*.

GAGLIARDI, who pretended to have diſcovered an infinite number of claviculi, (*a*) or

---

(*a*) In his *Anat. oſſium nov. invent. illuſtrat.* he deſcribes four kinds of theſe claviculi, or nails, viz. the perpendicular, oblique, headed and crooked.

bony proceſſes, which he deſcribes as traverſing the laminæ to unite them together, has endeavoured to ſupport this pretended diſcovery by the analogy of bones to the bark of trees, in which certain woody nails have been remarked—but this opinion ſeems to be altogether fanciful.

Some writers have ſuppoſed, that the bones are formed by layers of the perioſteum, which gradually oſſify, in the ſame manner as the timber is formed in trees by the hardening of the white ſubſtance that is found between the inner bark and the wood. M. Duhamel, who has adopted this opinion, fed different animals with madder and their ordinary food alternately during a certain time; and he aſſerts, that in diſſecting their bones, he conſtantly obſerved diſtinct layers of red and white, which correſponded with the length of time they had lived on madder, or their uſual aliment. But it has ſince been proved by Detleff, that M. Duhamel's experiments were inaccurate, and that neither the perioſteum, nor the cartilages, are tinged by the uſe of madder, which is known to affect the bones only.

We uſually conſider in a bone, its body and its extremities.—The ancients gave the name of diaphyſis to the body or middle part, and divided the extremities into apophyſis and epiphyſis.—An apophyſis, or proceſs, as it is more commonly called, is an eminence continued from the body of the bone, whereas an epiphyſis is at firſt a ſort of an appendage to the bone, by means of an intermediate cartilage. Many epiphyſes, which appear as diſtinct bones in the fœtus, become at length ſo completely united to the body of the bone, as not to be diſtinguiſhable from it in the adult ſtate. It is not unuſual, however, at the age of eighteen and even twenty years, to find the extremities of bones ſtill in the ſtate of epiphyſis.

The names given to the proceſſes of bones, are expreſſive of their ſhape, ſize, or uſe; thus if a proceſs is large, and of a ſpherical form, it is called caput, or head;—if the head is flatted, it is termed condyle.—Some proceſſes, from their reſemblance to a ſtiletto, a breaſt, or the beak of a crow, are called ſtyloid, maſtoid, or coracoid: others are ſtiled ridges or ſpines.—The two proceſſes of the os femoris derive their name of *trochanters* from their uſe.

A BONE has its cavities as well as proceſſes. Theſe cavities either extend quite through its ſubſtance, or appear only as depreſſions. The former are called foramina or holes, and theſe foramina are ſometimes termed canals or conduits, according to their form and extent—Of the depreſſions, ſome are uſeful in articulation.—Theſe are called *cotyloid* when they are deep, as is the caſe with the os innominatum, where it receives the head of the os femoris; or *glenoid* when they are ſuperficial, as in the ſcapula, where it receives the os humeri. Of the depreſſions that are not deſigned for articulation, thoſe which have ſmall apertures are called ſinuſes; others that are large, and not equally ſurrounded by high brims, are ſtiled foſſæ—Such as are long and narrow, furrows; or if broad and ſuperficial without brims, ſinuoſities. Some are called digital impreſſions, from their reſemblance to the traces of a finger on ſoft bodies.

## *Of the Connection of the Bones.*

We ſhall abridge this article, which is exceedingly diffuſe in the generality of anatomical books, and will endeavour to deſcribe it with all the clearneſs it will allow.

The bones compoſing the ſkeleton are ſo conſtructed, that the end of every bone is perfectly adapted to the extremity of that with which it is connected, and this connection forms what is called their articulation.

Articulation is divided into *diarthroſis*, *ſynarthroſis*, and *amphiarthroſis*, or moveable, immoveable, and mixed articulation. Each of the two firſt has its ſubdiviſions. Thus the *Diarthroſis*, or moveable articulation, includes 1. the enarthroſis, as it is called, when a large head is admitted into a deep cavity, as in the articulation of the os femoris with the os innominatum. 2. Arthrodia, when a round head is articulated with a ſuperficial cavity, as is the caſe of the os humeri and ſcapula. 3. Ginglimus, or hinge like articulation, as in the connection of the thigh bone with the tibia.

bia. The enarthroſis and arthrodia allow of motion to all ſides; the ginglimus only of flexion and extenſion.

The *Synarthroſis*, or immoveable articulation, includes 1. The ſuture, when the two bones are indented into each other, as is the caſe with the parietal bones. 2. Gomphoſis, when one bone is fixed into another, in the manner the teeth are placed in their ſockets.

The term *Amphiarthroſis* is applied to thoſe articulations which partake both of the ſynarthroſis and diarthroſis, as is the caſe with the bodies of the vertebræ, which are capable of motion in a certain degree, although they are firmly connected together by intermediate cartilages.

What is called *Symphyſis*, is the union of two bones into one, as in the lower jaw, for inſtance, which in the fœtus conſiſts of two diſtinct bones, but becomes one in a more advanced age, by the oſſification of the uniting cartilage.

When bones are thus joined by the means of cartilages, the union is ſtiled *ſynchondroſis*— When by ligaments, *ſyneuroſis*.

## *Of the Cartilages.*

Cartilages are white, ſolid, ſmooth, and elaſtic ſubſtances, between the hardneſs of bones and ligaments, and ſeemingly of a fibrous texture. We are not able to trace any veſſels into their ſubſtance by injection, nor are they ever found tinged in animals that have been fed with madder.

They may be diſtinguiſhed into 1ſt, thoſe which are connected with the bones; and 2dly, thoſe which belong to other parts of the body. The firſt ſerve either to cover the ends and cavities of bones intended for motion, as in the articulations, where by their ſmoothneſs they facilitate motions, which the bones alone could not execute with ſo much freedom; or they ſerve to unite bones together, as in the ſymphyſis pubis, or to lengthen them as in the ribs.

Many of them oſſifying as we advance in life, their number is leſs in the adult than in the fœtus, and of courſe there are fewer bones in the old than in the young ſubject.

Of the ſecond claſs of cartilages, or thoſe belonging to the ſoft parts, we have inſtances in the larynx, where we find them uſeful in the formation of the voice, and for the attachment of muſcles.

## *Of the Perioſteum.*

The perioſteum is a fine membrane of a compact cellular texture, reflected from one joint to another, and ſerving as a common covering to the bones. It adheres very firmly to their ſurface, and by its ſmoothneſs facilitates the motion of muſcles. It likewiſe ſupports the veſſels that go to be diſtributed through the ſubſtance of the bones, and may ſerve to ſtrengthen the articulations. At the extremities of bones, where it is found covering a cartilage, it has by ſome been improperly conſidered as a diſtinct membrane, and named *perichondrium*. Where it covers the bones of the ſkull, it has gotten the name of *pericranium*.

THE perioſteum is not a production of the dura mater, as the ancients, and after them Havers imagined, nor are the bones formed by the oſſification of this membrane, as ſome late writers have ſuppoſed.

THE perioſteum is deficient in the teeth above the ſockets, and in thoſe parts of bones to which ligaments or tendons are attached.

## *Of the Marrow.*

THE marrow is a fat, oily ſubſtance, filling the cavities of bones. In the great cavities of long bones it is of a much firmer conſiſtence than in the cells of their ſpongy part. In the former it inclines ſomewhat to a yellowiſh tinge, and is of the conſiſtence of fat; in the latter it is more fluid, and of a red colour. This difference in colour and conſiſtence is owing to accidental cauſes; both kinds are of the ſame nature, and may both be deſcribed under the common name of marrow, though ſome writers give this name only to the fat-like ſubſtance, and call the other the medullary juice.

THE marrow is contained in a very fine and tranſparent membrane, which is ſupplied with a great number of blood-veſſels, chiefly from the perioſteum. This membrana medullaris adheres to the inner ſurface of the bones, and furniſhes an infinite number of minute bags or veſicles for incloſing the marrow, which is likewiſe ſupported in the cavities of the bones by the long filaments of their reticular ſubſtance.

BESIDES the veſſels from the perioſteum, the membrana medullaris is furniſhed with others, which in the long bones may be ſeen paſſing in near the extremities of the bone, and ſending off numerous branches that ramify through all the veſicles of this membrane.

THE bones, and the cells containing the marrow, are likewiſe furniſhed with lymphatics. By their means, the marrow, like the fat, may be taken up in a greater quantity than it is ſecreted; and hence it is that ſo little is found in the bones of thoſe who die of lingering diſeaſes.

IT is ſtill a matter of controverſy, whether the marrow is ſenſible or not. We are certainly not able to trace any nerves to it, and from this circumſtance, and its analogy to fat, Haller has ventured to conſider it as inſenſible. On the other hand, Duverney aſſerts, that an injury done to this ſubſtance in a living animal, was attended with great pain. In this diſpute phyſiologiſts do not ſeem to have ſufficiently diſcriminated between the marrow itſelf and the membranous cells in which it is contained. The former, like the fat, being nothing more than a ſecreted and of courſe an inorganized matter, may with propriety be ranked among the inſenſible parts, as much as inſpiſſated mucus, or any other ſecreted matter in the body; whereas the membrana medullaris being vaſcular, though it poſſeſſes but an obſcure degree of feeling in a ſound ſtate, is not perfectly inſenſible.

The marrow was formerly ſuppoſed to be intended for the nouriſhment and renewal of the bones, but this doctrine is now pretty generally and deſervedly exploded. It ſeems probable that the marrow is to the bones what fat is to the ſoft parts. They both ſerve for ſome important purpoſes in the animal œconomy, but their particular uſe has never yet been clearly aſcertained. The marrow, from the tranſudation of the oil through the bones of a ſkeleton, is ſuppoſed to diminiſh their brittleneſs; and Havers goes ſo far, as to deſcribe the canals by which it is conveyed through every part of their ſubſtance. But from ſome recent enquiries on this ſubject, I am convinced that theſe pretended canals in a dry bone, are nothing more than the tracts of blood-veſſels, into which, when thoſe veſſels are deſtroyed, the marrow, which then becomes oily, and burſts from its cells, eaſily inſinuates itſelf, and makes its way through the ſubſtance of the bone to its outer ſurface. There do not ſeem to be any ſuch pores in a freſh bone; and in the living body, the marrow is not a fluid oil, but a congealed fat incloſed, as we have ſeen, within its proper cells.

## *Of the Synovial Glands.*

The ſynovial glands are ſmall bodies, ſeemingly of a glandular ſtructure, and exceedingly vaſcular, ſecreting a fluid of a white mucilaginous nature, which ſerves to lubricate the joints.—They are placed in ſmall cavities in the articulations, ſo as to be capable of being gently compreſſed by the motion of the joint, which expreſſes their juice in proportion to the degree of friction.—When the ſynovia is wanting, or is of too thick a conſiſtence, the joint becomes ſtiff and incapable of flexion or extenſion.—This is what is termed anchyloſis.

## *Of the Ligaments.*

LIGAMENTS are white, gliſtening, inelaſtic bands, of a compact ſubſtance, more or leſs broad or thick, and ſerving to connect the bones together.—They are diſtinguiſhed by different names adapted to their different forms and uſes.—Thoſe of the joints are called either round or burſal.—The round ligaments are white, tendinous, and inelaſtic. They are ſtrong and flexible, and are found only in the joint of the knee, and in the articulation of the os femoris with the os innominatum. The burſal, or capſular ligaments, ſurround the whole joint like a purſe, and are to be found in the articulations which allow motion every way—as in the articulation of the arm with the ſcapula.

## *Of the Skeleton.*

The word *ſkeleton*, which by its etymology implies ſimply a dry preparation, is uſually applied to an aſſemblage of all the bones of an animal, united together in their natural order.—It is ſaid to be a natural ſkeleton, when the bones are connected together by their own proper ligaments, and an artificial one, when they are joined by means of wire.

The ſkeleton is generally divided into the head, trunk, and extremities.—The firſt diviſion includes the bones of the cranium and face.—The bones of the trunk are the ſpine, ribs, ſternum, and bones of the pelvis.

The upper extremity on each ſide conſiſts of the two bones of the ſhoulder, viz. the ſcapula and clavicle; the bone of the arm or os humeri; the bones of the fore arm, and thoſe of the hand.

The lower extremity on each ſide of the trunk, conſiſts of the thigh-bone, and the bones of the leg and foot.

## SECTION II.

### *Of the Bones of the Head.*

THE head is of a roundiſh figure, and ſomewhat oval (*b*). Its greateſt diameter is from the forehead to the occiput; its upper part is called *vertex*, or crown of the head; its anterior or fore-part the face, and the upper part of this *ſinciput*, or forehead; its ſides the temples; its poſterior, or hind part, the *occiput*; and its inferior part the *baſis*.

THE bones of the head may be divided into thoſe of the cranium, and face.—

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(*b*) The bones of the fœtus being perfectly diſtinct, and the muſcles in young perſons not acting much, the ſhape of the head has been ſuppoſed to depend much on the management of children, when very young. Veſalius, who has remarked the difference in people of different nations, obſerves for inſtance, that the head of a Turk is conical, from the early uſe of the turban; whilſt that of an Engliſhman is flattened by the chin-ſtay. But the ingenious Dr. Camper, who has made many curious enquiries on this ſubject, ſuppoſes, with good reaſon, that this difference is chiefly owing to certain natural cauſes with which we are as yet unacquainted.

THERE are eight bones of the cranium, viz. the coronal bone, or os frontis; the two parietal bones, or oſſa bregmatis; the os occipitis; the two temporal bones; the ſphenoid bone, and the os ethmoides, or cribiforme.

OF theſe, only the os occipitis, and oſſa bregmatis, are conſidered as proper to the cranium; the reſt being common both to the cranium and face.

THESE bones are all harder at their ſurface than in their middle—and on this account they are divided into two tables, and a middle ſpongy ſubſtance called *diplöe.*

## *Of the Os Frontis*

IN this, as in all the other bones, we ſhall conſider its figure, ſtructure, proceſſes, depreſſions and cavities; and the manner in which it is articulated with the other bones.

THE os frontis has ſome reſemblance in ſhape to the ſhell of the cockle. Externally it is convex, its concave ſide being turned towards the brain. This bone, in the places where it is united to the temporal bones, is very thin, and has there no diplöe. It is likewiſe exceedingly thin in that part of the orbit of the eye which is neareſt to the noſe. Hence it is, that a wound in the eye, by a ſword, or any other pointed inſtrument, is ſometimes productive of immediate death. In theſe caſes, the ſword paſſing through the weak part of the bone, penetrates the brain, and divides the nerves at their origin; or perhaps opens ſome blood-veſſel, the conſequences of which are ſoon fatal.

We obſerve on the exterior ſurface of this bone, five apophyſes or proceſſes, which are eaſily to be diſtinguiſhed. One of theſe is placed at the bottom and narroweſt part of the bone, and is called the naſal proceſs, from its ſupporting the upper end of the bones of the noſe. The four others are called orbitar proceſſes. They ſerve to form the orbits, which are the cavities in which the eyes are placed. In each of theſe orbits there are two proceſſes, one at the interior or great angle, and the other at the exterior or little angle of the orbit. They are called the angular proceſſes. Betweeen theſe a ridge is extended in form of an arch, and on this the eye-brows are placed. It is called the orbitar or ſuperciliary ridge, and in ſome meaſure covers and defends the globe of the eye. This arch is interrupted near the noſe by a ſmall pit, in which the tendon of the muſculus obliquus major of the eye is fixed. In each orbit, under the external proceſs, a conſiderable depreſſion is obſerved, in which the lachrymal gland is lodged.

In the anterior part of the os frontis, there is a conſiderable diſcontinuation of it, which is filled up by the cribiform part of the os ethmoides.

On examining the inner ſurface of this bone, we obſerve an elevation in form of a ridge, which has been called the ſpinous proceſs; it paſſes from the anterior to the poſterior part of the bone, dividing it into two conſiderable foſſæ, in which the anterior lobes of the brain are placed. To a narrow furrow in this ridge, is attached the extremity of the falx, as the membrane is called, which divides the brain into two hemiſpheres. Beſides theſe two foſſæ, there are many depreſſions, which appear like digital impreſſions, and owe their formation to the prominent circumvolutions of the brain.

In the fœtus, the forehead is compoſed of two diſtinct bones; ſo that in them the ſagittal ſuture reaches from the os occipitis to the noſe.—This bone is almoſt every where compoſed of two tables and a diplöe. Theſe two tables ſeparating from each other under the eyes, form two cavities, one on each ſide of the face, called the frontal ſinuſes. Theſe ſinuſes are lined with a ſoft membrane, called membrana pituitaria. In theſe ſinuſes a mucus is ſecreted, which is conſtantly paſſing through two ſmall holes into the noſtrils, which it ſerves to moiſten.

The os frontis is joined by ſuture to many of the bones of the head, viz. to the parietal, maxillary, and temporal bones; to the os ethmoides; os ſphenoides; os unguis; and oſſa naſi. The ſuture which connects it with the parietal bones, is called the coronal ſuture.

## *Of the Parietal Bones.*

The parietal bones are two in number; they are very thin, and even tranſparent in ſome places. The particular figure of each of theſe bones is that of an irregular ſquare, bordered with indentations through its whole circumference, except at its lower part. It will be eaſily conceived, that theſe bones, which compoſe the ſuperior and lateral parts of the cranium, and cover the greateſt part of the brain, form a kind of vault. On their inner ſurface, we obſerve the marks of the veſſels of the dura mater.

The oſſa parietalia are joined to each other by the ſagittal ſuture; to the os ſphenoides and oſſa temporum by the ſquamous ſuture; to the os occipitis by the lambdoidal ſuture (*c*), ſo called from its reſemblance to the Greek letter lambda, and to the os frontis by the coronal ſuture.

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(*c*) The lambdoidal ſuture is ſometimes very irregular, being compoſed of many ſmall ſutures, which ſurround ſo many little bones called oſſa triquetra, though perhaps improperly, as they are not always triangular.

In the fœtus, the parietal bones are ſeparated from the middle of the divided os frontis by a portion of the cranium, then unoſſified.

## *Of the Occipital Bone.*

The occipital bone forms the poſterior and inferior parts of the ſcull; it approaches nearly to the ſhape of a lozenge, and is indented throughout three parts of its circumference.

There is a conſiderable hole in the inferior portion of this bone, called the foramen magnum, through which the medulla oblongata paſſes into the ſpine.—The nervi acceſſorii and vertebral arteries, likewiſe paſs through it. Beſides this, there are uſually four other holes peculiar to this bone, and two which are common to it and the oſſa temporum.—Theſe foramina ſerve for the paſſage of the blood-veſſels and nerves. At the ſides, and a little on the anterior part of the foramen magnum, are two proceſſes, called the condyles, one on each ſide; they are of an oval figure, and are covered with cartilage.

THE external ſurface of this bone, which is very irregular, affords attachment to ſeveral muſcles.—On examining its inner ſurface, we may obſerve a croſs-like appearance, formed by a prominent ridge, that riſes upwards from near the foramen magnum, and by two tranſverſe ſinuoſities, one on each ſide of the ridge. Theſe ſinuoſities ſerve for the reception of the lateral ſinuſes. Four foſſæ are formed by the croſs, two above, and two below the ſinuoſities.—In the former are placed the poſterior lobes of the brain, and in the latter the lobes of the cerebellum.

AT the upper part of the os occipitis, we may perceive a continuation of the furrow for the longitudinal ſinus; and at the baſis of the cranium, the cuneiform proceſs (which is the name given to the great apophyſis at the fore part of this bone) is made for the reception of the medulla oblongata.

THE os occipitis is of greater ſtrength and thickneſs, than either of the other bones of the head, though irregularly ſo—at its inferior part, where it is thinneſt, it is covered by a great number of muſcles.

This bone, from its ſituation, being more liable to be injured by falls than any other bone of the head, nature has wiſely given it the greateſt ſtrength at its upper part, where it is moſt expoſed to danger.

It is joined to the parietal bones by the lambdoidal ſuture, and to the oſſa temporum, by the additamentum of the temporal ſuture. It is likewiſe connected to the os ſphenoides by the cuneiform proceſs. It is by means of the os occipitis, that the head is united to the trunk, the two condyles of this bone being connected to the ſuperior oblique proceſſes of the firſt vertebra of the neck.

## *Of the Temporal Bones.*

There are two temporal bones, one on each ſide.—We may diſtinguiſh in them two parts, one of which is called the ſquamous, or ſcaly part, and the other os petroſum, from its hardneſs. This laſt is ſhaped like a pyramid.

Each of theſe diviſions affords proceſſes and cavities—externally there are three proceſſes—one anterior, called the zygomatic proceſs; one poſterior, called the maſtoid or mamillary proceſs, from its reſemblance to a nipple; and one inferior, called the ſtyloid proceſs, becauſe it is ſhaped like a ſtiletto, or dagger.

The cavities are, 1. The meatus auditorius externus. 2. A large foſſa which ſerves for the articulation of the lower jaw; it is before the meatus auditorius, and immediately under the zygomatic proceſs. 3. The ſtylo-maſtoid hole, ſo called from its ſituation between the ſtyloid and maſtoid proceſſes—it is likewiſe ſtyled the aquæduct of Fallopius, and affords a paſſage to the portio dura of the auditory, or ſeventh pair of nerves. 4. Below, and on the fore part of the laſt foramen, we obſerve part of the jugular foſſa, in which the beginning of the internal jugular vein is lodged. Anterior and ſuperior to this foſſa, is the orifice of a foramen, through which paſſes the carotid artery. This foramen runs firſt upwards and then forwards, forming a kind of elbow, and terminates at the end of the os petroſum.—At this part of each temporal bone, we may obſerve the opening of the

Euſtachian tube, a canal which paſſes from the ear to the mouth.

In examining the internal ſurface of theſe bones, we may remark the triangular figure of their petrous part which ſeparates two foſſæ; one ſuperior and anterior; the other inferior and poſterior; the latter of theſe compoſes part of the foſſa, in which the cerebellum is placed; and the former, a portion of the leaſt foſſa for the baſis of the brain.—On the poſterior ſide of the os petroſum, we obſerve the meatus auditorius internus, into which enters the double nerve of the ſeventh pair.

The os petroſum contains ſeveral little bones called the bones of the ear, which, as they do not enter into the formation of the cranium, ſhall be deſcribed when we are treating of the organs of hearing.

The oſſa temporum are joined to the oſſa malarum by the zygomatic ſutures; to the parietal bones by the ſquamous ſutures; to the os occipitis by the lambdoidal ſuture;

and to the ſphenoid bone, by the ſuture of that name.

## *Of the Os Sphenoides.*

This bone, from its ſituation amidſt the other bones of the head, has been ſometimes called cuneiforme. It is of a very irregular figure, and has been compared to a bat with its wings extended.

It is commonly divided into its middle part or body, and its ſides or wings.

On whatever ſide we view it, we diſcover only proceſſes and cavities.—The proceſſes, both external and internal, are ſo very numerous, that it will be ſufficient perhaps for us to deſcribe the principal ones, of which there are three on the outſide. One of theſe is in the middle, and is ſhaped like a creſt, making part of the ſeptum narium; the other two are, the pterygoid, or aliform proceſſes, one on each ſide of the body of the bone, and at no great diſtance from it.—Each of theſe proceſſes is divided into two wings, and of theſe the exterior one is the wideſt—The other terminates in a hook-like proceſs.

THE internal ſurface of this bone affords three foſſæ.—Two of theſe are formed by the wings of the bone, and make part of the leſſer foſſæ of the baſis of the cranium.—The third, which is ſmaller, is on the top of the body of the bone, and is called ſella turcica, from its reſemblance to a Turkiſh ſaddle.—This foſſa, in which the pituitary gland is placed, has poſteriorly and anteriorly proceſſes called the clinoid proceſſes.

THERE are eight holes in this bone, viz. four on each ſide; ſeveral pair of nerves, and ſome blood-veſſels paſs through them.

WITHIN the ſubſtance of the os ſphenoides, there are two ſinuſes ſeparated by a bony plate. They are lined with the pituitary membrane, and like the frontal ſinuſes, ſeparate a mucus which paſſes into the noſtrils.

THE os ſphenoides is joined to all the bones of the cranium, and likewiſe to the oſſa maxillaria, oſſa malarum, oſſa palati, and vomer.

This bone makes part of the baſis of the ſkull, aſſiſts in forming the orbits, and affords attachment to ſeveral muſcles.

## *Of the Os Ethmoides.*

The os ethmoides is ſituated at the fore part of the baſis of the cranium, and is of a very irregular figure. From the great number of holes with which it is pierced, it is ſometimes called *os cribiforme* or ſieve-like bone.

It conſiſts of a middle part and two ſides. The middle part is formed of a thin bony plate, in which are an infinite number of holes, that afford a paſſage to filaments of the olfactory nerve. From the middle of this plate, both on the outſide and from within, there riſes up a proceſs which may be eaſily diſtinguiſhed. The inner one is called criſta galli, from its ſuppoſed reſemblance to a cock's comb. To this proceſs the falx of the dura mater is attached. The exterior proceſs, which has the ſame common baſis as the criſta galli, is a fine lamella which is united to the vomer, and divides the cavity of the noſtrils, though unequally, it being generally a little inclined to one ſide.

THE lateral parts of this bone are compoſed of a cellular ſubſtance, and theſe cells are ſo very intricate, that their figure or number cannot be deſcribed.—Many writers have on this account, called this part of the bone the labyrinth. Theſe cells are externally covered with a very thin bony lamella. This part of the bone is called the os planum, and forms part of the orbit.

THE different cells of this bone, which are ſo exceedingly numerous, and which are every where lined with the pituitary membrane, evidently ſerve to enlarge the cavity of the noſe in which the organ of ſmelling reſides.

THIS bone is joined to the os ſphenoides; os frontis; oſſa maxillaria; oſſa palati; oſſa naſi; oſſa unguis, and vomer.

THE ancients, who conſidered the brain as the ſeat of all the humours, imagined that this viſcus diſcharged its redundant moiſture through the holes of the ethmoid bone. And the vulgar ſtill think, that abſceſſes of the brain diſcharge themſelves through the mouth and ears, and that ſnuff is liable to get into the head; but neither ſnuff nor the matter of an abſceſs are more capable of paſſing through the cribiform bone, than the ſeroſity which they ſuppoſed was diſcharged through it in a common cold.—All the holes of the ethmoid bone are filled up with the branches of the olfactory nerve. Its inner part is likewiſe covered with the dura mater, and its cells are every where lined with the pituitary membrane; ſo that neither matter nor any other fluid can poſſibly paſs through this bone either externally or internally. Matter is, indeed, ſometimes diſcharged through the noſtrils; but the ſeat of the diſeaſe is in the ſinuſes of the noſe, and not in the brain; and impoſthumations are obſerved to take place in the ear, which ſuppurate and diſcharge themſelves externally.

Before we leave the bones of the head, we wiſh to make ſome general obſervations on its ſtructure and figure.—As the cranium might have been compoſed of a ſingle bone, the articulation of its ſevaral bones being abſolutely without motion, it may be aſked, perhaps, why ſuch a multiplicity of bones, and ſo great number of ſutures? Many advantages may poſſibly ariſe from this plurality of bones and ſutures, which may not yet have been obſerved.—We are able, however, to point out many uſeful ends, which could only be accompliſhed by this peculiarity of ſtructure. —In this, as in all the other works of nature, the great wiſdom of the Creator is evinced, and cannot fail to excite our admiration and gratitude.

The cranium, by being divided into ſeveral bones, grows much faſter and with greater facility, than if it was compoſed of one piece only. In the fœtus, the bones, as we have before obſerved, are perfectly diſtinct from each other. The oſſification begins in the middle of each bone, and proceeds gradually to the circumference.—Hence the oſſification, and of courſe the increaſe of the head, is carried on from an infinite number of points at the ſame time, and the bones conſequently approach each other in the ſame proportion. To illuſtrate this doctrine more clearly, if it can want further illuſtration, ſuppoſe it neceſſary for the parietal bones, which compoſe the upper-part of the head, to extend their oſſification, and form the fore-part of the head likewiſe. —Is it not evident, that this proceſs would be much more tedious than it is now, when the os frontis and the parietal bones are both growing at the ſame time? Hence it happens, that the heads of young people, in which the bones begin to touch each other, increaſe ſlowly; and that the proportionate increaſe of the volume of the head is greater in three months in the fœtus, than it is perhaps in twenty-four months, at the age of fourteen or fifteen years.

The ſutures, excluſive of their advantages in ſuſpending the proceſſes of the dura mater, are evidently of great utility in preventing the too great extent of fractures of the ſkull.—Suppoſe, for inſtance, that by a fall or blow, one of the bones of the cranium becomes fractured—The fiſſure, which in a head compoſed of only one bone, would be liable to extend itſelf through the whole of it, is checked, and ſometimes perhaps ſtopped by the firſt ſuture it meets, and the effects of the injury are confined to the bone on which the blow was received. Ruyſch indeed, and ſome others, will not allow the ſutures to be of any ſuch uſe; but I have met with caſes, where they ſeemed to have had this effect; and in young ſubjects, their utility in this reſpect muſt be ſtill more obvious.

THE ſpherical ſhape of the head ſeems likewiſe to render it more capable of reſiſting external violence than any other ſhape would do. In a vault, the parts mutually ſupport and ſtrengthen each other, and this happens in the cranium.

## *Of the Bones of the Face.*

THE face, which conſiſts of a great number of bones, is commonly divided into the upper and lower jaws.—The upper jaw conſiſts of thirteen bones, excluſive of the teeth. Of theſe, ſix are placed on each ſide of the maxilla ſuperior, and one in the middle.

THE bones, which are in pairs, are the oſſa malarum; oſſa maxillaria; oſſa naſi; oſſa unguis; oſſa palati; and oſſa ſpongioſa inferiora —The ſingle bone is the vomer.

## *Of the Oſſa Malarum.*

These are the prominent ſquare bones which are placed under the eyes, forming part of the orbits, and the upper part of the cheeks. Each of them affords three ſurfaces; one exterior and a little convex; a ſecond ſuperior and concave, forming the inferior part and ſides of the orbit; and a third poſterior, irregular, and hollowed for the lodgement of the lower part of the temporal muſcle.

The angles of each bone form four proceſſes, two of which may be called orbitar proceſſes; of theſe the upper one is joined by future to the os frontis, and that below to the maxillary bone. The third is connected with the os ſphenoides by means of the tranſverſe future; and the fourth is joined to the zygomatic proceſs of the temporal bone, with which it forms the zygoma.

## *Of the Oſſa Maxillaria ſuperiora.*

These bones, which are of a very irregular figure, are ſo called, becauſe they form the moſt conſiderable portion of the upper jaw—

They are two in number, and generally remain diſtinct thro' life.

Of the many proceſſes which are to be ſeen on theſe bones, and which are connected with the bones of the face and ſkull, we ſhall deſcribe only the moſt remarkable.

One of theſe proceſſes is at the upper and fore-part of the bone, making part of the ſide of the noſe, and called the naſal proceſs—Another forms a kind of circular ſweep at the inferior part of the bone, in which are the alveoli, or ſockets for the teeth—this is called the alveolar proceſs—A third proceſs is united to the os malæ on each ſide—The alveolar proceſs has poſteriorly a conſiderable tuberoſity on its internal ſurface, called the maxillary tuberoſity.

Behind the alveolar proceſs we obſerve two horizontal lamellæ, which uniting together, form part of the roof of the mouth, and divide it from the noſe. The hollowneſs of the roof of the mouth, is owing to this partition's being ſeated ſomewhat higher than the alveolar proceſs.

In viewing theſe bones internally, we obſerve a foſſa in the inferior portion of the naſal proceſs, which, with the os unguis, forms a paſſage for the lachrymal duct.

Where theſe two bones are united to each other they project ſomewhat forwards, leaving between them a furrow, into which the lower portion of the ſeptum naſi is admitted.

Each of theſe bones being hollow, a conſiderable ſinus is formed under its orbitar part. This cavity, which is uſually named after Highmore, though it was deſcribed by Fallopius and others before his time, is lined with the pituitary membrane. It is intended for the ſame purpoſes as the other ſinuſes of the noſe, and opens into the noſtrils.

The oſſa maxillaria are connected with the greater part of the bones of the face and cranium, and aſſiſt in forming not only the cheeks, but likewiſe the palate, noſe, and orbits.

## *Of the Oſſa Naſi.*

The oſſa naſi form two irregular ſquares. They are thicker and narrower above than below—Externally they are ſomewhat convex, and internally ſlightly concave—Theſe bones conſtitute the upper part of the noſe—at their fore part they are united to each other; above to the os frontis; by their ſides to the oſſa maxillaria ſuperiora; poſteriorly and interiorly to the ſeptum narium, and below to the cartilages that compoſe the reſt of the noſtrils.

## *Of the Oſſa Unguis.*

These little tranſparent bones owe their name to their ſuppoſed reſemblance to a finger-nail. Sometimes they are called *oſſa lachrymalia*, from their concurring with the naſal proceſs of each maxillary bone in forming a lodgement for the lachrymal ſac and duct.

The oſſa unguis are of an irregular figure. Their external ſurface conſiſts of two ſmooth parts, divided by a middle ridge. One of theſe parts, which is concave and neareſt to the noſe, ſerves to ſupport the lachrymal ſac, and part of the lachrymal duct. The other, which is flat, forms a ſmall part of the orbit.

Each of theſe bones is connected with the os frontis, os ethmoides, and os maxillare ſuperius.

## *Of the Oſſa Palati.*

These bones, which are ſituated at the back part of the roof of the mouth, between the os ſphenoides and the oſſa maxillaria ſuperiora, are of a very irregular ſhape, and ſerve to form the naſal and maxillary foſſa, and a ſmall portion of the orbit. Where they are united to each other, they riſe up into a ſpine on their internal ſurface—this ſpine appears to be a continuation of that of the ſuperior maxillary bones, and helps to form the ſeptum narium.

These bones are joined to the oſſa maxillaria ſuperiora, os ethmoides, os ſphenoides, and vomer.

## *Of the Vomer.*

This bone derives its name from its reſemblance to a plough-ſhare.—It is a long and flat bone, ſomewhat thicker at its back than at its fore part. At its upper part we obſerve a furrow extending through its whole length—The poſterior and largeſt part of this furrow receives a proceſs of the ſphenoid bone—from this the furrow advances forwards, and becoming narrower and ſhallower, receives ſome part of the naſal lamella ethmoidea; the reſt ſerves to ſupport the middle cartilage of the noſe.

THE inferior portion of this bone is placed on the naſal ſpine of the maxillary and palate bones, which we mentioned in our deſcription of the oſſa palati.

THE vomer is united to the os ſphenoides; os ethmoides; oſſa maxillaria ſuperiora; and, oſſa palati—It forms part of the ſeptum narium, by dividing the back part of the noſe into two noſtrils.

## *Of the Oſſa Spongioſa Inferiora.*

THE parts which are uſually deſcribed by this name, do not ſeem to deſerve to be diſtinguiſhed as diſtinct bones, except in young ſubjects. They conſiſt of a ſpongy lamella in each noſtril, which is united to the ſpongy lamina of the ethmoid bone, of which they are by ſome conſidered as a part.

EACH of theſe lamellæ is longeſt from behind, forwards; with its convex ſurface turned towards the ſeptum narium, and its concave part towards the maxillary bone, covering the opening of the lachrymal duct into the noſe.

THESE bones are covered with the pituitary membrane; and, beſides their connection with the ethmoid bone, are joined to the oſſa maxillaria ſuperiora; oſſa palati; and oſſa unguis.

## *Of the Maxilla Inferior.*

THE maxilla inferior, or lower jaw, which, in its ſhape reſembles a horſe-ſhoe, conſiſts of two diſtinct bones in the fœtus, but theſe unite together ſoon after birth, ſo as to form only one bone. The upper edge of this bone, like the os maxillare ſuperius, has an alveolar proceſs, furniſhed with ſockets for the teeth.

ON each ſide, the poſterior part of the bone riſes almoſt perpendicularly into two proceſſes.

The higheſt of theſe, called the coronoid proceſs, is pointed and thin, and ſerves for the inſertion of the temporal muſcle. The other, or condyloid proceſs as it is called, is ſhorter and thicker, and ends in an oblong rounded head, which is received into a foſſa of the temporal bone, and is formed for a moveable articulation with the cranium. This joint is furniſhed with a moveable cartilage. At the bottom of each coronoid proceſs, on its inner part, we obſerve a foramen extending under the roots of all the teeth, and terminating at the outer ſurface of the bone near the chin. Each of theſe canals tranſmits an artery, vein, and nerve, from which branches are ſent off to the teeth.

The lower jaw is capable of a great variety of motion. By ſliding the condyles from the cavity towards the eminences on each ſide, we bring it horizontally forwards, as in biting; or we may bring the condyles only forward, and tilt the reſt of the jaw backward, as in opening the mouth; we are likewiſe able to ſlide the condyles alternately backwards and forwards from the cavity to the eminence, and vice verſa, as in grinding the teeth. The cartilages,

tilages, by adapting themſelves to the different inequalities in theſe ſeveral motions of the jaw, ſerve to ſecure the articulation, and to prevent any injuries from friction.

The alveolar proceſſes are compoſed of an outer and inner bony plate, united together by thin partitions, which, at the fore part of the jaw, divide the proceſſes into as many ſockets as there are teeth. But at the back part of the jaw, where the teeth have more than one root, we find a diſtinct cell for each root. In both jaws theſe proceſſes begin to be formed with the teeth; they likewiſe accompany them in their growth, and gradually diſappear when the teeth are removed.

## *Of the Teeth.*

The teeth are bones of a particular ſtructure, formed for the purpoſes of maſtication and the articulation of the voice. It will be neceſſary to conſider their compoſition and figure; their number and arrangement; and the time and order in which they appear.

In each tooth we may diſtinguiſh a body, a neck, and a root, or fangs.

THE body of the tooth is that part which appears above the gums. The root is fixed into the ſocket, and the neck is the middle part between the two.

THE teeth are compoſed of two ſubſtances, viz. enamel and bone—The enamel, or the vitreous or cortical part of the tooth, is a white, and very hard and compact ſubſtance peculiar to the teeth, and appears fibrous or ſtriated when broken. This ſubſtance is thickeſt on the grinding ſurface, and becoming gradually thinner, terminates inſenſibly at the neck of the tooth. Ruyſch (*a*) affirmed, that he could trace the arteries into the hardeſt part of the teeth; Lewenhoeck (*b*) ſuſpected the fibres of the enamel to be ſo many veſſels; and Monro (*c*) ſays, he has frequently injected the veſſels of the teeth in children, ſo as to make the inſide of the cortex appear perfectly red. But it is certain that it is not tinged by a madder diet, and that no injection will ever reach it, ſo that it has no appearance of being vaſcular (*d*).

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(*a*) Theſaur. 10. num. 27.

(*b*) Arcan. Natur. continuat. Epiſtol.

(*c*) Anatomy of the human bones.

(*d*) Hunter on the teeth.

The bony part, which compoſes the inner ſubſtance of the body, neck, and root of the tooth, reſembles other bones in its ſtructure, but it is much harder than the moſt compact part of bones in general. As a tooth when once formed receives no tinge from a madder diet, and as the minuteſt injections do not penetrate into its ſubſtance, this part of a tooth has, like the enamel, been ſuppoſed not to be vaſcular. But when we conſider that the fangs of a tooth are inveſted by a perioſteum, and that the ſwellings of theſe fangs are analogous to the ſwellings of other bones, we may reaſonably conclude that there is a ſimilarity of ſtructure, and that this bony part has a circulation through its ſubſtance, although from its hardneſs we are unable to demonſtrate its veſſels.

In each tooth we find an inner cavity, into which enter an artery, vein, and nerve. This cavity begins by a ſmall opening, and becoming larger, terminates in the body of the tooth. In advanced life this hole ſometimes cloſes, and the tooth is of courſe rendered inſenſible.

The perioſteum ſurrounds the teeth from their fangs to a little beyond their bony ſockets, where we find it adhering to the gums. This membrane, while it incloſes the teeth, ſerves at the ſame time to line the ſockets, ſo that it may be conſidered as common to both.

The teeth are likewiſe ſecured in their ſockets by means of the gums, a red, vaſcular, firm and elaſtic ſubſtance that poſſeſſes but little elaſticity. In the gums of infants we find a hard ridge extending through their whole length, but no ſuch ridge is to be ſeen in old people who have loſt their teeth.

The number of the teeth in both jaws at full maturity, uſually varies from twenty-eight to thirty-two. They are commonly divided into three claſſes, viz. inciſores, canini, and grinders or molares (*e*). The inciſores are the

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(*e*) Mr. Hunter has thought proper to vary this diviſion. He retains the old name of inciſores to the four fore teeth, but he diſtinguiſhes the canine teeth by the name of the cuſpidati. The two teeth which are next to theſe, and which have been uſually ranked with the molares, he calls the bicuſpides, and he gives the name of grinders only to the three laſt teeth on each ſide.

four teeth in the fore part of each jaw. They have each of them two ſurfaces, one anterior and convex, the other poſterior and ſlightly concave, both of which terminate in a ſharp edge. They are called inciſores from their uſe in dividing the food. They are uſually broader and thicker in the upper than in the under jaw, and by being placed ſomewhat obliquely generally fall over the latter.

THE canini derive their name from their reſemblance to a dog's tuſks, being the longeſt of all the teeth. We find one on each ſide of the inciſores, ſo that there are two canini in each jaw. Their fang reſembles that of the inciſores, but is much larger, and in their ſhape they appear like an inciſor with its edge worn off, ſo as to terminate in a narrow point.

THESE teeth not being calculated for cutting and dividing the food like the inciſores, or for grinding it like the molares, ſeem to be intended for laying hold of ſubſtances (*f*).

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(*f*) Mr. Hunter remarks of theſe teeth, that we may trace in them a ſimilarity in ſhape, ſituation and uſe, from the moſt imperfectly carnivorous animal, which we believe to be the human ſpecies, to the lion, which is the moſt perfectly carnivorous.

The molares, or grinders, of which there are ten in each jaw, are ſo called, becauſe from their ſhape and ſize they are fitted for grinding the food. Each of the inciſores and canini is furniſhed only with one fang, but in the molares of the under jaw, we conſtantly find two fangs, and in thoſe of the upper jaw three fangs. Theſe fangs are ſometimes ſeparated into two points, and each of theſe points has ſometimes been deſcribed as a diſtinct fang.

The two firſt of the molares, or thoſe neareſt to the canine teeth on each ſide, differ from the other three, and are with great propriety named bicuſpides by Mr. Hunter. They have ſometimes only one root, and ſeem to be of a middle nature between the inciſores and the larger molares. The two next are much larger. The fifth, or laſt grinder on each ſide, is ſmaller and ſhorter than the reſt; and from its not cutting the gum till after the age of twenty, and ſometimes not till much later in life, is called dens ſapientiæ.

There is in the ſtructure and arrangement of all theſe teeth, an art which cannot be ſufficiently admired. To underſtand it properly, it will be neceſſary to conſider the under jaw as a kind of lever, with its fixed points at its articulations with the temporal bones—it will be right to obſerve too that its powers ariſe from its different muſcles, but in elevation chiefly from the temporalis, and that the aliment conſtitutes the object of reſiſtance. It will appear then, that the molares by being placed neareſt the centre of motion are calculated to preſs with a much greater force than the other teeth, independent of their grinding powers, and that it is for this reaſon we put between them any hard body we wiſh to break.

The canini and inciſores are placed farther from this point, and of courſe cannot exert ſo much force; but they are made for cutting and tearing the food, and this form ſeems to make amends for their deficiency in ſtrength.

There are examples of children who have come into the world with two, three, and even four teeth—but theſe examples are very rare, and 'tis ſeldom before the ſeventh, eighth or ninth month after birth that the inciſores, which are the firſt formed, begin to paſs thro' the gum. The ſymptoms of dentition, how-

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ever, in conſequence of irritation from the teeth, frequently take place in the fourth or fifth month—about the twentieth or twenty-fourth month the canini and two molares make their appearance.

The dangerous ſymptoms that ſometimes accompany dentition, are owing to the preſſure of the teeth on the gum, which they irritate ſo as to excite pain and inflammation. This irritation ſeems to occaſion a gradual waſting of the gum at the part, till at length the tooth makes its appearance.

The ſymptoms are more or leſs alarming, in proportion to the reſiſtance which the gum affords to the teeth; and, according to the number of teeth, which may chance to ſeek a paſſage at the ſame time.—Were they all to appear at once, children would fall victims to the pain and exceſſive irritation; but nature has ſo very wiſely diſpoſed them, that they uſually appear one after the other with ſome diſtance of time between each. The firſt inciſor that appears is generally in the lower jaw, and is followed by one in the upper jaw. Sometimes the canini, but more commonly one of the molares, begins to paſs through the gum firſt.

These twenty teeth, viz. eight inciſores, four canini, and eight molares, are called *temporary* or *milk teeth*, becauſe they are all ſhed between the age of ſeven and fourteen, and are ſucceeded by what are called the *permanent* or *adult teeth*. The latter are of a firmer texture, and have larger fangs:

These adult teeth being placed in a diſtinct ſet of alveoli, the upper ſockets gradually diſappear, as the under ones increaſe in ſize, till at length the temporary, or upper teeth, having no longer any ſupport, conſequently fall out.

To theſe twenty teeth which ſucceed the temporary ones, twelve others are afterwards added, viz. three molares on each ſide in both jaws: and in order to make room for this addition, we find that the jaws gradually lengthen, in proportion to the growth of the teeth; ſo that with twenty teeth, they ſeem to be as completely filled as they are afterwards with thirty-two. This is the reaſon why the face

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is rounder and flatter in children, than in adults.

WITH regard to the formation of the teeth, we may obſerve, that in a fœtus of four months, the alveolar proceſs appears only as a ſhallow longitudinal groove, divided by minute ridges into a number of intermediate depreſſions; in each of which we find a ſmall pulpy ſubſtance, ſurrounded by a vaſcular membrane. This pulp gradually oſſifies, and its lower part is lengthened out to form the fang. When the bony part of the tooth is formed, its ſurface begins to be incruſted with the enamel. How the latter is formed and depoſited, we are not yet able to determine.

THE rudiments of ſome of the adult teeth begin to be formed at a very early period, for the pulp of one of the inciſores may generally be perceived in a fœtus of eight months, and the oſſification begins in it ſoon after birth. The firſt bicuſpis begins to oſſify about the fifth or ſixth, and the ſecond about the ſeventh year. The firſt adult grinder cuts the gum about the twelfth, the ſecond about the eighteenth,

teenth, and the third, or *dens ſapientiæ*, uſually between the twentieth and thirtieth year.

The teeth like other bones, are liable to be affected by diſeaſe. Their removal is likewiſe the natural conſequence of old age; for as we advance in life, the alveoli fill up, and the teeth, eſpecially the inciſores, fall out. When this happens, the chin projects forward, and the face is much ſhortened.

## *Of the Os Hyoides* (g).

The os hyoides which is placed at the root of the tongue, was ſo called by the ancients on account of its ſuppoſed reſemblance to the Greek letter υ.

It will be neceſſary to diſtinguiſh in it, its body, horns and appendices.

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(g) This bone is very ſeldom preſerved with the ſkeleton, and cannot be included amongſt the bones of the head or in any other diviſion of the ſkeleton. Thomas Bartholin has perhaps very properly deſcribed it among the parts contained in the mouth, but the generality of anatomical writers have placed it, as it is here, after the bones of the face.

The body which is the middle and broadeſt part of the bone, is ſo placed that it may be eaſily felt at the fore part of the throat. Anteriorly it is irregularly convex, and its inner ſurface is unequally concave—Its *cornua*, or horns, which are flat and a little bent; being much longer than the body part, may be deſcribed as forming the ſides of the υ. The appendices, or little horns, as they are called by M. Winſlow and ſome other writers, are two proceſſes which riſe up from the articulations of the cornua with the body, and are uſually connected with the ſtyloid proceſs on each ſide by means of a ligament.

The uſes of this bone are to ſupport the tongue, and afford attachment to a great number of muſcles, ſome of which perform the motions of the tongue, while others act on the larynx and fauces.

# SECTION III.

## *Of the Bones of the Trunk.*

THE trunk of the ſkeleton conſiſts of the ſpine, the thorax, and the pelvis.

## *Of the Spine.*

THE ſpine is compoſed of a great number of bones called vertebræ, forming a long bony column, in figure not much unlike the letter *ſ.* This column, which extends from the head to the lower part of the body, may be ſaid to conſiſt of two irregular and unequal pyramids, united to each other in that part of the loins where the laſt lumbar vertebra joins the os ſacrum.

THE vertebræ of the upper and longeſt pyramid, are called *true vertebræ*, in contradiſtinction to thoſe of the lowermoſt pyramid, which, from their being immoveable in the adult, are ſtiled *falſe vertebræ.* It is upon the bones of the ſpine that the body turns; and it is to this circumſtance they owe their name, which is derived from the Latin verb *vertere*, to turn.

THE true vertebræ are divided into three claſſes of cervical, dorſal, and lumbar vertebræ.—The falſe vertebræ conſiſt of the os ſacrum and os coccygis.

IN each vertebra, as in other bones, it will be neceſſary to remark the body of the bone, its proceſſes, and cavities.

THE body, which is convex before, and concave behind, where it aſſiſts in forming the cavity of the ſpine, may be compared to part of a cylinder cut off tranſverſely.

Each vertebra affords ſeven proceſſes. The firſt is at the back part of the vertebra, and from its ſhape and direction is named the *ſpinous* proceſs.—On each ſide of this are two others, which, from their ſituation with reſpect to the ſpine, are called *tranſverſe* proceſſes. The four others are ſtiled *oblique* or *articular* proceſſes. They are much ſmaller than the ſpinous or tranſverſe ones. Two of them are placed on the upper, and two on the lower part of each vertebra, riſing from near the baſis of each tranſverſe proceſs. They have gotten the name of oblique proceſſes, from their ſituation with reſpect to the proceſſes with which they are articulated; and they are ſometimes ſtiled articular proceſſes, from the manner in which they are articulated with each other; the two ſuperior proceſſes of one vertebra being articulated with the two inferior proceſſes of the vertebra above it. Each of theſe proceſſes is covered with cartilage at its articulation, and their articulations with each other are by a ſpecies of ginglimus.

In each vertebra, between its body and its proceſſes, we find a hole large enough to admit a finger. Theſe holes or foramina correſpond with each other through all the vertebræ, and form the long bony channel in which the ſpinal marrow is placed. We may likewiſe obſerve four notches in each vertebra. Two of theſe notches are at the upper, and two at the lower part of the bone, between the oblique proceſſes and the body of the vertebra. Each of theſe notches meeting with a ſimilar opening in the vertebra above or below

low it, forms a foramen for the paſſage of blood-veſſels, and of the nerves out of the ſpine.

The bones of the ſpine are united together by means of a ſubſtance, which, in young ſubjects, appears to be of a ligamentous, but in adults more of a cartilaginous nature. This intervertebral ſubſtance, which forms a kind of partition between the ſeveral vertebræ, is thicker and more flexible between the lumbar vertebræ than in the other parts of the ſpine, the moſt conſiderable motions of the trunk being performed on thoſe vertebræ. This ſubſtance being very elaſtic, the extenſion and flexion of the body, and its motion backwards and forwards, or to either ſide, are performed with great facility. This elaſticity ſeems to be the reaſon, why people who have been long ſtanding, or have carried a conſiderable weight, are found to be ſhorter than when they have been long in bed. In the two firſt inſtances the intervertebral cartilages (as they are uſually called) are evidently more expoſed to compreſſion than when we are in bed in an horizontal poſture.

In advanced life theſe cartilages become ſhrivelled, and of courſe loſe much of their elaſticity. This may ſerve to account for the decreaſe in ſtature and the ſtooping forward which are uſually to be obſerved in old people.

Besides the connection of the ſeveral vertebræ by means of this intervertebral ſubſtance, there are likewiſe many ſtrong ligaments, both external and internal, which unite the bones of the ſpine to each other. Their union is alſo ſtrengthened by a variety of ſtrong muſcles that cover and ſurround the ſpine.

The bones of the ſpine are found to diminiſh in denſity, and to be leſs firm in their texture in proportion as they increaſe in bulk, ſo that the lowermoſt vertebræ, though the largeſt, are not ſo heavy in proportion as the upper ones. By this means the ſize of theſe bones is increaſed without adding to their weight, a circumſtance of no little importance in a part like the ſpine, which, beſides flexibility and ſuppleneſs, ſeems to require lightneſs as one of its eſſential properties.

In very young children, each vertebra conſiſts of three bony pieces united by cartilages which afterwards oſſify.

## *Of the Vertebræ of the Neck.*

There are ſeven vertebræ of the neck—they are of a firmer texture than the other bones of the ſpine. Their tranſverſe proceſſes are forked for the lodgment of muſcles, and at the bottom of each we obſerve a foramen, through which paſs the cervical artery and vein. The firſt and ſecond of theſe vertebræ muſt be deſcribed more particularly—The firſt approaches almoſt to an oval ſhape—on its ſuperior ſurface it has two cavities which admit the condyles of the occipital bone with which is is articulated—This vertebra which is called *Atlas* from its ſupporting the head, cannot well be deſcribed as having either body or ſpinous proceſs, being a kind of bony ring. Anteriorly where it is articulated to the odontoid proceſs of the ſecond vertebra it is very thin.

The ſecond vertebra has gotten the name of *dentata* from its having, at its upper and anterior part, a proceſs called the *odontoid* or *tooth-like proceſs*, which is articulated with the atlas to which this ſecond vertebra may be ſaid to ſerve as an axis. This odontoid proceſs is of a cylindrical ſhape, ſomewhat flattened, however anteriorly and poſteriorly. At its fore part where it is received by the atlas, we may obſerve a ſmooth, convex, articulating ſurface. It is by means of this articulation that the head performs its rotatory motion, the atlas in that caſe moving upon this odontoid proceſs as upon a pivot. But when this motion is in any conſiderable degree, or in other words when the head moves much either to the right or left, all the cervical vertebræ ſeem to aſſiſt, otherwiſe the ſpinal marrow would be in danger of being divided tranſverſely by the firſt vertebra.

THE ſpinous proceſs of each of the cervical vertebræ is ſhorter, and their articular proceſſes more oblique than in the other bones of the ſpine.

### *Of the Vertebræ of the Back.*

THESE twelve vertebræ are of a middle ſize between thoſe of the neck and loins. At their ſides we may obſerve two depreſſions, one at the upper and the other at the lower part of the body of each vertebra, which uniting with ſimilar depreſſions in the vertebræ above and below, form articulating ſurfaces, covered with cartilages, for receiving the heads of the ribs; and at the fore part of their tranſverſe proceſs (excepting the two laſt) we find an articulating ſurface for receiving the tuberoſity of the ribs.

### *Of the Lumbar Vertebræ.*

These five vertebræ differ only from thoſe of the back in their being larger, and in having their ſpinous proceſſes at a greater diſtance from each other—The moſt conſiderable motions of the trunk are made on theſe vertebræ, and theſe motions could not be performed with ſo much eaſe, were the proceſſes placed nearer to each other.

### *Of the Os Sacrum.*

The os ſacrum which is compoſed of five or ſix pieces in young ſubjects, becomes one bone in more advanced age.

It is nearly of a triangular figure, its inferior portion being bent a little forwards. Its ſuperior part has two oblique proceſſes which are articulated with the laſt of the lumbar vertebræ; and it has likewiſe commonly three ſmall ſpinous proceſſes, which gradually become ſhorter, ſo that the lowermoſt is not ſo long as the ſecond, nor the ſecond as the uppermoſt. Its tranſverſe proceſſes are formed into one oblong proceſs, which becomes gradually ſmaller as it deſcends. Its concave or anterior ſide is uſually ſmooth, but its poſterior convex ſide has many prominences (the moſt remarkable of which, are the ſpinous proceſſes juſt now mentioned) which are filled up and covered with the muſcular and tendinous parts behind.

This bone has five pair of holes, which afford a paſſage to blood-veſſels, and likewiſe to the nerves that are derived from the ſpinal marrow, which is continued even here, being lodged in a triangular cavity, that becomes ſmaller as it deſcends, and at length terminates obliquely at the lower part of this bone. Below the third diviſion of the os ſacrum, this canal is not compleatly bony as in the reſt of the ſpine, being ſecured at its back part, only by a very ſtrong membrane, ſo that a wound at this part muſt be extremely dangerous.

The os ſacrum is united laterally to the oſſæ innominata or hip bones, and below to the coccyx.

## *Of the Coccyx.*

The coccyx, which like the os ſacrum is in young people made up of three or four diſtinct parts, uſually becomes one bone in the adult ſtate.

It ſerves to ſupport the inteſtinum rectum; and, by its being capable of ſome degree of motion at its articulation with the ſacrum, and being like that bone bent forwards, we are enabled to ſit with eaſe.

This bone is about three inches long, and is nearly of a triangular ſhape, being broadeſt at its upper part, and from thence growing narrower to its apex, where it is not bigger than the little finger.

It has gotten its name from its ſuppoſed reſemblance to a cuckow's beak. It differs greatly from the vertebræ, being commonly without any proceſſes, and having no cavity for the ſpinal marrow, or foramina for the tranſmiſſion of nerves.

The ſpine, of which we have now finiſhed the anatomical deſcription, is deſtined for many great and important uſes. The medulla ſpinalis is lodged in its bony canal ſecure from external injury.—It ſerves as a defence to the abdominal and thoracic viſcera, and at the ſame time ſupports the head, and gives a general firmneſs to the whole trunk.

We have before compared it to the letter *ſ* and its different turns will be found to render it not very unlike the figure of that letter.—In the neck we ſee it projecting ſomewhat forward to ſupport the head, which, without this aſſiſtance would require a greater number of muſcles—Lower down, in the thorax, we find it taking a curved direction backwards, and of courſe increaſing the cavity of the cheſt. After this, in the loins, it again projects forwards in a direction with the centre of gravity, by which means we are eaſily enabled to keep the body in an erect poſture, for otherwiſe we ſhould be liable to fall forward. Towards its inferior extremity however, it again recedes backward, and thus aſſiſts in forming the pelvis, the name given to the cavity in which the urinary bladder, inteſtinum rectum, and other viſcera are placed.

If this bony column had been formed only of one piece, it would have been much more eaſily fractured than it is now: and by confining the trunk to a ſtiff ſituation, a variety of motions would have been altogether prevented, which are now performed with eaſe by the great number of bones of which it is compoſed.

It is firm, and yet to this firmneſs there is added a perfect flexibility. If it be required to carry a load upon the head, the neck becomes ſtiff with the aſſiſtance of its muſcles, and accommodates itſelf to the load, as if it was compoſed only of one bone—In ſtooping likewiſe or in turning to either ſide, the ſpine turns itſelf in every direction, as if all its bones were ſeparated from each other.

In a part of the body, like the ſpine, that is made up of ſo great a number of bones, and intended for ſuch a variety of motion, there muſt be a greater danger of diſlocation than fracture; but we ſhall find, that this is very wiſely guarded againſt in every direction by the proceſſes belonging to each vertebra, and by the ligaments, cartilages, &c. by which theſe bones are connected with each other.

## *Of the Bones of the Thorax.*

The thorax, or cheſt, is compoſed of many bones, viz. the ſternum which is placed at its anterior part; twelve ribs on each ſide which make up its lateral parts, and the dorſal vertebræ which conſtitute its poſterior part. Theſe laſt have been already deſcribed.

## *Of the Sternum.*

The ſternum is the long bone which extends itſelf from the upper to the lower part of the breaſt anteriorly, and to which the ribs and the clavicles are articulated.

In children it is compoſed of ſeveral bones united by cartilages; but as we advance in life,

moſt

moſt of theſe cartilages oſſify, and the ſternum in the adult ſtate is found to conſiſt only of two pieces, and ſometimes becomes one bone—It is however generally deſcribed as being compoſed of two parts—one ſuperior, which is broad, thick and ſhort; and one inferior, which is thinner, narrower and longer than the other.

It terminates at its lower part by a cartilage which is called the xyphoid, or ſword-like cartilage, from its ſuppoſed reſemblance to the blade of a ſword, but its ſhape is much more like that of a myrtle leaf.

We have already obſerved, that this bone is articulated with the clavicle on each ſide—It is likewiſe joined to the fourteen true ribs, viz. ſeven on its right and ſeven on its left ſide.

## *Of the Ribs.*

The ribs are bones ſhaped like a bow, forming the ſides of the cheſt. There are twelve on each ſide. They are diſtinguiſhed into true and falſe ribs—The ſeven upper ribs which are articulated to the ſternum are called true ribs, and the five lower ones that are not immediately attached to that bone are called falſe ribs.

On the inferior and interior ſurface of each rib, we obſerve a ſinuoſity for the lodgement of an artery, vein and nerve.

The ribs are not bony through their whole length, their anterior part being cartilaginous. They are articulated with the vertebræ and ſternum—Every rib, (or at leaſt the greater number of them) has at its poſterior part two proceſſes; one at its extremity, called the head of the rib, by means of which it is articulated with the body of two vertebræ, and another, called its tuberoſity, by which it is articulated with the tranſverſe proceſs of the loweſt of theſe two vertebræ—The firſt rib is not articulated by its extremity to two vertebræ, being ſimply attached to the upper part of the firſt vertebra of the back—The ſeven ſuperior or true ribs are articulated anteriorly with the ſternum by their cartilages; but the falſe ribs are ſupported in a different manner—The eighth, which is the firſt of theſe ribs, being attached by its cartilage to the ſeventh—The ninth to the eighth, &c.

The two lowermoſt ribs differ likewiſe from all the reſt in the following particulars—They are articulated only with the body of a vertebra, and not with a tranſverſe proceſs; and anteriorly, their cartilage is looſe, not being attached to the cartilages of the other ribs; and this ſeems to be, becauſe the moſt conſiderable motions of the trunk are not performed on the lumbar vertebræ alone, but likewiſe on the two laſt vertebræ of the back, ſo that if theſe two ribs had been confined at the fore part like the other ribs, and had been likewiſe articulated with the bodies of two vertebræ, and with the tranſverſe proceſſes, the motion of the two laſt vertebræ, and conſequently of the whole trunk, would have been impeded.

The ribs help to form the cavity of the thorax; they afford attachment to different muſcles; they are uſeful in reſpiration; and they ſerve as a ſecurity to the heart and lungs.

## *Of the Bones of the Pelvis.*

THE pelvis is compoſed of the os ſacrum, os coccygis, and two oſſa innominata. The two firſt of theſe bones were included in our account of the ſpine, to which they more properly belong.

IN children, each os innominatum is compoſed of three diſtinct bones; but as we advance in life the intermediate cartilages gradually oſſify, and the marks of the original ſeparation diſappear, ſo that they become one irregular bone; ſtill however continuing to retain the names of ilium, iſchium and pubis, by which their diviſions were originally diſtinguiſhed, and to be deſcribed as three diſtinct bones by the generality of anatomiſts. The os ilium forms the upper and moſt conſiderable part of the bone, the os iſchium its lower and poſterior portion, and the os pubis its fore part.

## *Of the Os Ilium.*

THE os ilium or haunch bone, is articulated poſteriorly to the os ſacrum by a firm cartilaginous ſubſtance, and is united to the os pubis before and to the os iſchium below—its ſuperior portion is thin, and terminates in a ridge called the criſta or ſpine of the ilium, and more commonly known by the name of the haunch. This criſta riſes up like an arch, being turned ſomewhat outwards, ſo as to reſemble the wings of a phaeton.

Externally this bone is unequally prominent and hollowed for the lodgement of muſcles; internally we find it ſmooth and concave.—At its lower part there is a conſiderable ridge on its inner ſurface. This ridge, which extends from the os ſacrum, and correſponds with a ſimilar prominence both on that bone and the iſchium, forms with the inner part of the oſſa pubis what in midwifery is termed the brim of the pelvis.

The criſta, or ſpine, which at firſt is an epiphyſis, has two conſiderable tuberoſities, one anteriorly, and the other poſteriorly, which is the largeſt of the two—The ends of this ſpine too from their projecting more than the parts of the bone below them have gotten the name of ſpinal proceſſes—Before the anterior ſpinal

rocefs the ſpine is hollowed for the lodge-
nent of part of the ſartorius muſcle, and be-
ow the poſterior proceſs we obſerve a conſi-
lerable niche in the bone which in the recent
ubject, is formed into a large foramen, by
neans of a ſtrong ligament that is ſtretched
ver its lower part from the os ſacrum to the
harp-pointed proceſs of the iſchium. This
ole affords a paſſage to the great ſciatic nerve,
nd to the poſterior crural veſſels under the
yriform muſcle, part of which is likewiſe
laced in this foramen.

## *Of the Os Iſchium.*

THE os iſchium, or hip-bone, which is of a
ery irregular figure, conſtitutes the lower la-
eral parts of the pelvis, and is commonly di-
ided into its body, tuberoſity and ramus.
The body forms the lower and moſt conſider-
ble portion of the acetabulum, and ſends a
harp-pointed proceſs backwards, called the
ſpine of the iſchium. To this proceſs the li-
ament adheres, which was juſt now ſpoken
f, as forming a foramen for the paſſage of the
ciatic nerve.—The tuberoſity, which is the
oweſt part of the trunk, and ſupports us when

we ſit, is large and irregular, affording origin to ſeveral mucles. From this tuberoſity we find the bone becoming thinner and narrower. This part, which has the name of ramus or branch, paſſes forwards and upwards, and concurs with the ramus of the os pubis, to form a large hole called the *foramen magnum iſchii*, or *thyroideum*, as it is ſometimes named from its reſemblance to a door or ſhield. This hole, which in the recent ſubject is cloſed by a ſtrong membrane called the obturator ligament, affords through its whole circumference attachment to muſcles. At its upper part where we obſerve a nitch in the bone, it gives paſſage to blood-veſſels and to the poſterior crural nerve. Nature ſeems every where to avoid an unneceſſary weight of bone, and this foramen, no doubt, ſerves to lighten the bones of the pelvis.

## *Of the Os Pubis.*

The os pubis or ſhare-bone, which with its fellow forms the fore-part of the pelvis, is the ſmalleſt diviſion of the os innominatum. It is united to its fellow by means of a ſtrong cartilage, which forms what is called the ſymphyſis pubis.

In each os pubis we may diſtinguiſh the body of the bone, its angle, and ramus. The body or outer part is united to the os ilium. The angle comes forwards to form the ſymphyſis, and the ramus is a thin proceſs which unites with the ramus of the iſchium, to form the foramen thyroideum.

The three bones we have deſcribed as compoſing each os innominatum, all aſſiſt in forming the acetabulum, in which the head of the os femoris is received.

In this cavity we may obſerve a little foſſa, in which are lodged the mucilaginous glands of the joint. We may likewiſe notice the pit or depreſſion made by the round ligament, as it is improperly called, which by adhering to this cavity and to the head of the thigh-bone, helps to ſecure the latter in the ſocket.

These bones, which are united to each other and to the ſpine by many very ſtrong igaments, ſerve to ſupport the trunk, and to connect it with the lower extremities; and at he ſame time to form the pelvis or baſon, in which are lodged the inteſtines and urinary bladder, and in women the uterus, ſo that the ſtudy of this part of oſteology is of the utmoſt importance in midwifery.

It is worthy of obſervation, that in women the os ſacrum is uſually ſhorter, broader, and more hollowed, the oſſa ilia more expanded, and the inferior opening of the pelvis larger than in men.

## SECTION IV.

### *Of the Extremities.*

THESE parts of the ſkeleton conſiſt of the upper and lower extremities—We will begin with the upper one, which conſiſts of the ſhoulder, arm and hand—The ſhoulder is compoſed of two bones, the clavicula and ſcapula.

### *Of the Clavicula.*

THIS bone, which is ſo named, from its reſemblance to the key in uſe amongſt the ancients, is a little curved at both its extremities like an italic *ſ*. It is likewiſe called *jugulum*, or collar-bone, from its ſituation. It is about the ſize of the little finger, but longer, and being of a very ſpongy ſubſtance is very liable to be fractured. In this as in other long bones we may diſtinguiſh a body and two extremities. The body is rather flattened than rounded. The anterior extremity is formed into a ſlightly convex head, which is nearly of a triangular ſhape. The inferior ſurface of the head is articulated with the ſternum. The poſterior extremity which is flatter and broader than the other, is connected to a proceſs of the ſcapula, called acromion. Both theſe articulations are ſecured by ligaments, and in that with the ſternum we meet with a moveable cartilage, to prevent any injury from friction.

The clavicle ſerves to regulate the motions of the ſcapula, by preventing it from being brought too much forwards, or carried too far backwards. It affords origin to ſeveral muſcles, and helps to cover and protect the ſubclavian veſſels which derive their name from their ſituation under this bone.

## *Of the Scapula.*

The ſcapula, or ſhoulder-blade, which is nearly of a triangular ſhape, is fixed to the poſterior part of the true ribs ſomewhat in the manner of a buckler. It is of a very unequal thickneſs, and like all other broad, flat bones, is ſomewhat cellular. Exteriorly it is convex, and interiorly concave, to accommodate itſelf to the convexity of the ribs. We obſerve in this bone three unequal ſides. The largeſt of the three called the baſis is turned towards the vertebræ. Another which is leſs than the former is below this, and the third, which is the leaſt of the three, is at the upper part of the bone. Externally the bone is elevated into a conſiderable ſpine, which riſing ſmall at the baſis of the ſcapula becomes gradually higher and broader, and divides the outer ſurface of the bone into two foſſæ. The ſuperior of theſe, which is the ſmalleſt, ſerves to lodge the ſupra ſpinatus muſcle; and the inferior foſſa which is much larger than the other, gives origin to the infra ſpinatus. This ſpine terminates in a broad and flat proceſs at the top of the ſhoulder, called the proceſſus acromion, to which the clavicle is articulated. This proceſs is hollowed at its lower part to allow a paſſage to the ſupra and infra ſpinati muſcles —The ſcapula has likewiſe another conſiderable proceſs at its upper part, which, from its reſemblance to the beak of a bird, is called the coracoid proceſs—from the outer ſide of this coracoid proceſs, a ſtrong ligament paſſes to the proceſſus acromion, which prevents a luxation of the os humeri upwards.

The ſcapula is articulated with the clavicle and os humeri, to which laſt it ſerves as a fulcrum; and by varying its poſition it affords a greater ſcope to the bones of the arm in their different motions. It likewiſe gives origin to ſeveral muſcles, and poſteriorly ſerves as a defence to the trunk.

## *Of the Bones of the Arm.*

The arm is commonly divided into two parts, which are articulated to each other at the elbow. The upper part retains the name of arm properly ſo called, and the lower part is uſually called the fore arm.

The arm is compoſed of a ſingle bone called *os humeri*. This bone which is almoſt of a cylindrical ſhape, may be divided into its body and its extremities.

The upper extremity terminates in a large, round ſmooth head, which is admitted into the glenoid cavity of the ſcapula.

The lower extremity has many proceſſes and cavities. The principal proceſſes are its two condyles, one exterior and the other interior, and of theſe the laſt is the largeſt; between theſe two we obſerve two lateral protuberances, which together with a middle cavity, form as it were a kind of pully upon which the motions of the fore arm are chiefly performed—At each ſide of the condyles, as well exteriorly as interiorly, there is another eminence which gives origin to ſeveral muſcles of the hand and fingers. Poſteriorly and ſuperiorly, ſpeaking with reſpect to the condyles, we obſerve a deep foſſa which receives a conſiderable proceſs of the ulna; and anteriorly and oppoſite to this foſſa, we obſerve another, which is much leſs, and receives another proceſs of the ſame bone.

The body of the bone has at its upper and anterior part, a furrow which begins from behind the head of the bone, and ſerves to lodge the tendon of a muſcle—The body of the os humeri is hollow through its whole length, and like all other long bones has its marrow.

This bone is articulated at its upper part to the ſcapula. This articulation, which allows motion every way, is ſurrounded by a caſpular ligament that is ſometimes torn in luxation, and becomes an obſtacle to the caſy reduction of the bone. Its lower extremity is articulated with the bones of the fore arm.

## *Of the Fore Arm.*

THE fore arm is compoſed of two bones, the ulna and radius.

## *Of the Ulna.*

THE ulna or elbow-bone is much leſs than the os humeri, and becomes gradually ſmaller as it deſcends to the wriſt. At its upper part it has two proceſſes and two cavities. Of the two proceſſes, the largeſt, which is ſituated poſteriorly and called the olecranon, is admitted into the poſterior foſſa of the os humeri. The other proceſs is placed anteriorly, and is called the coronoid proceſs. In bending the arm it enters into the anterior foſſa of the os humeri. This proceſs being much ſmaller than the other, permits the fore arm to bend inwards; whereas the olecranon, which is ſhaped like a hook, reaches the bottom of its foſſa in the os humeri as ſoon as the arm becomes ſtraight, and will not permit the fore arm to be bent backwards—The ligaments likewiſe oppoſe this motion.

BETWEEN the two proceſſes we have deſcribed, there is a conſiderable cavity called the ſygmoid cavity, divided into two foſſæ by a ſmall eminence, which paſſes from one proceſs to the other; it is by means of this cavity and the two proceſſes, that the ulna is articulated with the os humeri by ginglimus.

AT the bottom of the coronoid proceſs interiorly, there is a ſmall ſygmoid cavity, which ſerves for the articulation of the ulna with the radius.

THE body of the ulna is of a triangular ſhape—its lower extremity terminates by a ſmall head and a little ſtyloid proceſs—The ulna is articulated above to the os humeri—both above and below to the radius, and to the wriſt at its lower extremity—All theſe articulations are ſecured by means of ligaments—The chief uſe of this bone ſeems to be to ſupport and regulate the motions of the radius.

## *Of the Radius.*

THE radius, which is ſo named from its ſuppoſed reſemblance to the ſpoke of a wheel, is placed at the inſide of the fore arm—it is ſomewhat larger than the ulna, but not quite ſo long as that bone—Its upper part is cylindrical, hollowed ſuperiorly to receive the outer condyle of the os humeri—laterally it is admitted into the little ſygmoid cavity of the ulna, and the cylindrical part of the bone turns in this cavity in the motions of pronation and ſupination (*f*)—This bone follows the ulna in flexion and extenſion, without at all aſſiſting in thoſe motions—The lower extremity of the radius is much larger and ſtronger than its upper part; the ulna, on the contrary, is ſmaller and weaker below than above; ſo that they ſerve to ſupply each others deficiencies in both thoſe parts.

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(*f*) The motions of pronation and ſupination may be eaſily deſcribed. If the palm of the hand, for inſtance, is placed on the ſurface of a table, the hand may be ſaid to be in a ſtate of pronation—but if the back part of the hand is turned towards the table, the hand will then be in a ſtate of ſupination.

On the external ſide of this bone, we obſerve a ſmall cavity which is deſtined to receive the lower end of the ulna; and its lower extremity is formed into a large cavity, by means of which it is articulated with the bones of the wriſt, and on this account it is ſometimes called *manubrium manus*. It ſupports the two firſt bones of the wriſt on the ſide of the thumb, whereas the ulna is articulated with that bone of the wriſt which correſponds with the little finger.

Through the whole length both of this bone and the ulna, a ridge is obſerved which affords attachment to an interoſſeous ligament—This ligament fills up the ſpace between the two bones.

## *Of the Carpus.*

The carpus or wriſt conſiſts of eight ſmall bones, of an irregular ſhape, and diſpoſed in two unequal rows. Thoſe of the upper row are articulated with the bones of the fore arm, and thoſe of the lower one with the metacarpus.

The ancient anatomiſts deſcribed theſe bones numerically; Lyſerus ſeems to have been the firſt who gave to each of them a particular name. The names he adopted are founded on the figure of the bones, and are now pretty generally received, except the firſt, which inſtead of κοτυλοέιδες, (the name given to it by Lyſerus, on account of its ſinus, that admits a part of the os magnum) has by later writers, been named *Scaphoides* or *Naviculare*. This which is the outermoſt of the upper row, (conſidering the thumb as the outer ſide of the hand) is articulated with the radius; on its inner ſide it is connected with the os lunare, and below to the trapezium and trapezoides. Next to this is a ſmaller bone called the os lunare, becauſe its outer ſide, which is connected with the ſcaphoides, is ſhaped like a creſcent. This is likewiſe articulated with the radius. On its inner ſide it joins the os cuneiforme, and anteriorly, the os magnum and os unciforme.

The os cuneiforme, which is the third bone in the upper row, is compared to a wedge, from its being broader above, at the back of the hand, than it is below.—Poſteriorly it is articulated with the ulna, and anteriorly with the os unciforme.

THESE three bones form an oblong articulating ſurface, covered by cartilage, by which the hand is connected with the fore arm.

THE *os piſiforme*, or pea-like bone, which is ſmaller than the three juſt now deſcribed, though generally claſſed with the bones of the upper row, does not properly belong to either ſeries, being placed on the under ſurface of the os cuneiforme, ſo as to project into the palm of the hand. The four bones of the ſecond row correſpond with the bones of the thumb and fingers; the firſt, ſecond and fourth are from their ſhapes named *trapezium*, *trapezoides*, and *unciforme*; the third from its being the largeſt bone of the carpus, is ſtiled *os magnum.*

ALL theſe bones are convex towards the back, and ſlightly concave towards the palm of the hand; their articulating ſurfaces are covered with cartilages, and ſecured by many ſtrong ligaments, particularly by two ligamentous expanſions, called the external and internal annular ligaments of the wriſt. The former extends in an oblique direction from the os piſiforme to the ſtyloid proceſs of the radius, and is an inch and a half in breadth;

the latter or internal annular ligament, is ſtretched from the os piſiforme and os unciforme, to the os ſcaphoides and trapezium. Theſe annular ligaments likewiſe ſerve to bind down the tendons of the wriſt and fingers.

## *Of the Metacarpus.*

THE metacarpus conſiſts of four bones, which ſupport the fingers—externally they are a little convex, and internally ſomewhat concave, where they form the palm of the hand—They are hollow, and of a cylindrical ſhape.

AT each extremity they are a little hollowed for their articulation ſuperiorly with the bones of the carpus, and inferiorly with the firſt phalanx of the fingers, in the ſame manner as the ſeveral phalanges of the fingers are articulated with each other.

## *Of the Fingers.*

THE five fingers of each hand are compoſed of fifteen bones, diſpoſed in three ranks called phalanges—The bones of the firſt phalanx, which are articulated with the metacarpus, are the largeſt, and thoſe of the laſt phalanx the ſmalleſt—All theſe bones are larger at their extremities than in their middle part.

We obſerve at the extremities of the bones of the carpus, metacarpus and fingers, ſeveral inequalities that ſerve for their articulation with each other; and theſe articulations are ſtrengthened by means of the ligaments which ſurround them.

It will be eaſily underſtood that this multiplicity of bones in the hand (for there are twenty-ſeven in each hand) is eſſential to the different motions we wiſh to perform—If each finger was compoſed only of one bone inſtead of three, it would be impoſſible for us to graſp any thing.

## Of the Lower Extremities.

Each lower extremity is divided into four parts, viz. The os femoris, or thigh bone —The rotula, or knee-pan—The leg, and the foot.

## Of the Os Femoris.

The thigh is compoſed only of this bone, which is the largeſt and ſtrongeſt we have.

It will be neceſſary to diſtinguiſh its body and extremities—Its body, which is of a cylindrical ſhape, is convex before and concave behind, where it ſerves to lodge ſeveral muſcles—Throughout two-thirds of its length, we obſerve a ridge called *linea aſpera*, which originates from the trochanters, and after running for ſome way downwards, divides into two branches, that terminate in the tuberoſities at the lower extremity of the bone.

At its upper extremity we muſt deſcribe the neck and head of the bone, and likewiſe two conſiderable proceſſes—The head, which forms the greater portion of a ſphere unequally divided, is turned inwards, and received into the great cotyloid cavity of the os innominatum—At this part of the bone there is a little foſſa to be obſerved, to which the round ligament is attached, and which we have already deſcribed as tending to ſecure the head of this bone in the great acetabulum—The neck is almoſt horizontal conſidered with reſpect to its ſituation with the body of the bone—Of the two proceſſes, the external one, which is the largeſt, is called trochanter major, and the other, which is placed on the inſide of the bone, trochanter minor—They both afford attachment to muſcles—The articulation of the os femoris with the trunk, is ſtrengthened by means of a capſular ligament, which adheres every where to the ſurface of the great cotyloid cavity of the os innominatum, and ſurrounds the head of the bone.

The os femoris moves upon the trunk in every direction.

At the lower extremity of the bone are two proceſſes called the condyles, and an intermediate cavity, by means of which it is articulated with the leg by ginglimus.

Between the condyles there is a cavity poſteriorly, in which the blood-veſſels and nerves are placed, ſecure from the compreſſion to which they would otherwiſe be expoſed in the action of bending the leg, and which would not fail to be hurtful.

At the ſide of each condyle externally, there is a tuberoſity, from whence the lateral ligaments originate, which are extended down to the tibia.

A ligament likewiſe ariſes from each condyle poſteriorly. One of theſe ligaments paſſes from the right to the left, and the other from the left to the right, ſo that they interſect each other, and for that reaſon are called the croſs ligaments.

The lateral ligaments prevent the motion of the leg upon the thigh to the right or left, and the croſs ligaments, which are alſo attached to the tibia, prevent the latter from being brought forwards.

In new-born children all the proceſſes of this bone are cartilaginous.

## *Of the Rotula.*

The rotula, patella, or knee-pan, as it is differently called, is a flat bone about four or five inches in circumference, and is placed at the fore part of the joint of the knee. In its ſhape it is ſomewhat like the common figure of the heart, with its point downwards.

It is thinner at its edge than in its middle part; at its fore part it is ſmooth and ſomewhat convex—its poſterior ſurface, which is more unequal, affords an elevation in the middle which is admitted between the two condyles of the os femoris.

This bone is retained in its proper ſituation by a ſtrong ligament which every where ſurrounds it, and adheres both to the tibia and os femoris; it is likewiſe firmly connected with the tibia by means of a ſtrong tendinous ligament of an inch in breadth, and upwards of two inches in length, which adheres to the lower part of the patella, and to the tuberoſity at the upper end of the tibia. On account of this connexion it is very properly conſidered as an appendage to the tibia, which it follows in all its motions, ſo as to be to it what the olecranon is to the ulna. There is this difference however, that the olecranon is a fixed proceſs, whereas the patella is moveable, being capable of ſliding from above downwards, and from below upwards. This mobility is eſſential to the rotatory motion of the leg.

In very young children this bone is entirely cartilaginous.

The principal uſe of the patella ſeems to be to defend the articulation of the knee from ex-

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ternal injury—it likewiſe tends to increaſe the power of the extenſor muſcles of the leg, by removing their direction farther from the center of motion in the manner of a pulley.

## *Of the Leg.*

The leg is compoſed of two bones—Of theſe the inner one, which is the largeſt, is called tibia—the other is much ſmaller, and named fibula.

## *Of the Tibia.*

The tibia, which is ſo called from its reſemblance to the muſical pipe of the ancients, has three ſurfaces, and is not very unlike a triangular priſm—Its poſterior ſurface is the broadeſt; anteriorly it has a conſiderable ridge called the ſhin, between which and the ſkin there are no muſcles—At the upper extremity of this bone are two ſurfaces, a little concave, and ſeparated from each other by an intermediate elevation—The two little cavities receive the condyles of the os femoris, and the eminence between them is admitted into the cavity which we ſpoke of as being between the two condyles, ſo that this articulation affords a ſpecimen of the complete ginglimus—Under the external edge of the upper end of this bone is a circular flat ſurface, which receives the head of the fibula.

At the lower and inner portion of the tibia, we obſerve a conſiderable proceſs called malleolus internus—The baſis of the bone terminates in a large tranſverſe cavity, by which it is articulated with the uppermoſt bone of the foot—It has likewiſe another cavity at its lower end and outer ſide, which is ſomewhat oblong, and receives the lower end of the fibula.

The tibia is hollow thro' its whole length.

## *Of the Fibula.*

The fibula is a ſmall long bone ſituated on the outſide of the tibia—Its ſuperior extremity does not reach quite ſo high as the upper part of the tibia, but its lower end deſcends ſomewhat lower—Both above and below, it is articulated with the tibia by means of the lateral cavities we noticed in our deſcription of that bone.

Its lower extremity is ſtretched out into a coronoid proceſs, which is flattened at its inſide, and is convex externally, forming what is called the malleolus externus, or outer ancle—This is rather lower than the malleolus internus of the tibia.

The body of this bone, which is irregularly triangular, is a little hollow at its internal ſurface, which is turned towards the tibia; and it affords like that bone, through its whole length, attachment to a ligament, which from its ſituation is called the interoſſeous ligament.

## *Of the Bones of the Foot.*

The foot conſiſts of the tarſus, metatarſus, and toes.

### *Of the Tarſus.*

The tarſus is compoſed of ſeven bones, viz. The aſtragalus, os calcis, os naviculare, os cuboides, and three others called cuneiform bones.

The astragalus is a large bone with which both the tibia and fibula are articulated. It is the uppermoſt bone of the foot—

—it has ſeveral ſurfaces to be conſidered—its upper, and ſomewhat poſterior part, which is ſmooth and convex, is admitted into the cavity of the tibia—Its lateral parts are connected with the malleoli of the two bones of the leg—below, it is articulated with the os calcis, and its anterior ſurface is received by the os naviculare—All theſe articulations are ſecured by means of ligaments.

THE OS CALCIS, or CALCANEUM, which is of a very irregular figure, is the largeſt bone of the foot—Behind, it is formed into a conſiderable tuberoſity called the heel—without this tuberoſity, which ſupports us in an erect poſture, and when we walk, we ſhould be liable to fall backwards.

ON the internal ſurface of this bone, we obſerve a conſiderable ſinuoſity, which affords a paſſage to the tendon of a muſcle: and to the poſterior part of the os calcis, a ſtrong tendinous cord called tendo achillis (*g*) is attached, which is formed by the tendons of ſeveral muſcles united together—The articulation of

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(*g*) This tendon is ſometimes ruptured by jumping, dancing, or other violent efforts.

this with the other bones, is ſecured by means of ligaments.

THE OS NAVICULARE, or SCAPHOIDES (for theſe two terms have the ſame ſignification) is ſo called on account of its reſemblance to a little bark. At its poſterior part, which is concave, it receives the aſtragalus ; anteriorly it is articulated with the cuneiform bones, and laterally it is connected with the os cuboides.

THE OS CUBOIDES forms an irregular cube. Poſteriorly it is articulated with the os calcis ; anteriorly it ſupports the two laſt bones of the metatarſus, and laterally it joins the third cuneiform bone and the os naviculare.

EACH of the OSSA CUNEIFORMIA, which are three in number, reſembles a wedge, and from this ſimilitude their name is derived. They are placed next to the metatarſus by the ſides of each other, and are uſually diſtinguiſhed into *os cuneiforme externum*, *medium* or *minimum*, and *internum* or *maximum*—The ſuperior ſurface of theſe bones, from their wedge-like ſhape, is broader than that which is below, where they help to form the ſole of the foot—

poſteriorly they are united to the os naviculare, and anteriorly they ſupport the three firſt metatarſal bones.

When theſe ſeven bones compoſing the tarſus are viewed together in the ſkeleton, they appear convex above where they help to form the upper part of the foot, and concave underneath, where they form the hollow of the foot, in which the veſſels, tendons, and nerves of the foot are placed ſecure from preſſure.

They are united to each other by very ſtrong ligaments, and their articulation with the foot is ſecured by a capſular and two lateral ligaments; each of the latter is covered by an annular ligament of conſiderable breadth and thickneſs, which ſerves to bind down the tendons of the foot, and at the ſame time to ſtrengthen the articulation.

The os cuneiforme externum is joined laterally to the os cuboides.

These bones complete our account of the tarſus; though what we have ſaid of this part of the oſteology has been very ſimple and conciſe, yet, many readers may not clearly underſtand it—but if they will be pleaſed to view theſe bones in their proper ſituation in the ſkeleton, all that we have ſaid of them will be eaſily underſtood.

## *Of the Metatarſus.*

THE metatarſus is made up of five bones, whereas the metacarpus conſiſts only of four. The cauſe of this difference is, that in the hand the laſt bone of the thumb is not included among the metacarpal bones, whereas in the foot the great toe has only two bones. The firſt of theſe bones ſupports the great toe and is much larger than the reſt, which nearly reſemble each other in ſize.

THESE bones are articulated by one extremity with the cuneiform bones and the os cuboides, and by their other end, with the toes.

## *Of the Bones of the Toes.*

EACH of the toes like the fingers, conſiſts of three bones, except the great toe, which is formed of two bones. Thoſe of the other four are diſtinguiſhed into three phalanges. Although the toes are more confined in their motion than the fingers, yet they appear to be perfectly fitted for the purpoſes they are deſigned for. In walking the toes bring the centre of gravity perpendicular to the advanced foot, and as the ſoles of the foot are naturally concave, we can at pleaſure increaſe this concavity, and form a kind of vault, which adjuſts itſelf to the different inequalities that occur to us in walking, and which without this mode of arrangement would incommode us exceedingly, eſpecially when barefooted.

## *Of the Oſſa Seſamoidea.*

Besides the bones we have already deſcribed, there are ſeveral ſmall ones that are met with only in the adult ſkeleton, and in perſons who are advanced in life, which from their ſuppoſed general reſemblance to the ſeeds of the ſeſamum are called *oſſa ſeſamoidea*— They are commonly to be ſeen at the firſt joint of the great toe, and ſometimes at the joints of the thumb; they are likewiſe now and then to be found at the lower extremity of the fibula,

bula, upon the condyles of the thigh-bone, under the os cuboides of the tarſus, and in other parts of the body. Their ſize and number ſeem conſtantly to be increaſed by age and hard labour; and as they are generally found in ſituations where tendons and ligaments are moſt expoſed to the action of muſcles, they are now generally conſidered as oſſified portions of ligaments or tendons.

THE upper ſurface of theſe bones is uſually convex, and adherent to the tendon that covers it; the ſide which is next to the joint is ſmooth and flat. Though their formation is accidental, yet they ſeem to be of ſome uſe, by raiſing the tendons farther from the centre of motion, and conſequently increaſing the power of the muſcles. In the great toe and thumb they are likewiſe uſeful, by forming a groove for the flexor tendons.

# CHAP. II.

## *Of the ſoft Parts in General,*

AND

## *Of the common Integuments.*

ANATOMICAL writers uſually proceed to a deſcription of the muſcles after having finiſhed the oſteology; but we ſhall deviate a little from the common method, with a view to deſcribe every thing clearly and diſtinctly, and to avoid a tautology which would otherwiſe be unavoidable—All the parts of the body are ſo intimately connected with each other, that it ſeems impoſſible to convey a juſt idea of any one of them, without being in ſome meaſure obliged to ſay ſomething of others—and on this account we wiſh to mention in this place the names and ſituation of the principal viſcera of the body, that when mention is hereafter made of any of them in the courſe of the work, the reader may at leaſt know where they are placed.

After this little digreſſion, the common integuments, and after them the muſcles, will be deſcribed; we then propoſe to enter into an examination of the ſeveral viſcera and their different functions—In deſcribing the brain, occaſion will be taken to ſpeak of the nerves and animal ſpirits. The circulation of the blood will follow the anatomy of the heart, and the ſecretions and other matters will be introduced in their proper places.

The body is divided into three great cavities—Of theſe the uppermoſt is formed by the bones of the cranium, and incloſes the brain and cerebellum—The ſecond is compoſed of the vertebræ of the back, the ſternum and true ribs with the additional aſſiſtance of muſcles, membranes and common integuments, and is called the thorax—It contains the heart and lungs.

The third and inferior cavity is the abdomen—It is ſeparated from the thorax by means of the diaphragm, and is formed by the lumbar vertebræ, the os ſacrum, the oſſa innominata, and the falſe ribs, to which we may add the peritonæum, and a variety of muſcles—This cavity incloſes the ſtomach, inteſtines, omentum or cawl, liver, pancreas, ſpleen, kidnies, urinary bladder, and parts of generation.

UNDER the diviſion of common integuments, are uſually included the epidermis, or ſcarf-ſkin; the reticulum mucoſum of Malpighi; the cutis, or true ſkin, and the membrana adipoſa—The hair and nails, as well as the ſebaceous glands, may be conſidered as appendages to the ſkin.

## SECTION I.

### *Of the Epidermis.*

THE epidermis, cuticula or ſcarf ſkin, is a fine, tranſparent and inſenſible pellicle, deſtitute of nerves and blood-veſſels, which inveſts the body, and every where covers the true ſkin. This ſcarf ſkin which ſeems to be very ſimple, appears, when examined with a microſcope, to be compoſed of ſeveral laminæ or ſcales which are increaſed by preſſure, as we may obſerve in the hands and feet, where it is frequently much thickened and becomes perfectly callous—It ſeems to adhere to the cutis by a number of very minute filaments, but may eaſily be ſeparated from it by heat or by maceration in water—Some anatomical writers have ſuppoſed that it is formed by a moiſture exhaled from the whole ſurface of the body, which gradually hardens when it comes into contact with the air. They were perhaps induced to adopt this opinion, by obſerving the ſpeedy regeneration of this part of the body when it has been by any means deſtroyed, it appearing to be renewed on all parts of the ſurface at the ſame time, whereas other parts which have been injured, are found to direct their growth from their circumference only towards their center—but a demonſtrative proof that the epidermis is not a fluid hardened by means of the external air, is, that the fœtus in utero is found to have this covering—Leeuwenhoeck ſuppoſed its formation to be owing to the expanſion of the extremities of the excretory veſſels, which are found every where upon the ſurface of the true ſkin: Ruyſch attributed its origin to the nervous papillæ of the ſkin, and Heiſter thinks it probable, that it may be owing both to the papillæ and the excretory veſſels. The celebrated Morgagni on the other hand contends *, that it is nothing more than the ſurface of the cutis, hardened and rendered inſenſible by the liquor amnii in utero, and by the preſſure of the air; this is a ſubject however, on which we can advance nothing with certainty.

THE cuticle is pierced with an infinite number of pores, or little holes, which afford a paſſage to the hairs, ſweat and inſenſible perſpiration,

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* Adverſar. Anat. II. Animadver. 2.

and likewiſe to warm water, mercury, and whatever elſe is capable of being taken in by the abſorbents of the ſkin—The lines which we obſerve on the epidermis belong to the true ſkin—The cuticle adjuſts itſelf to them, but does not form them.

SECTION

## SECTION II.

### *Of the Rete Mucoſum.*

BETWEEN the epidermis and cutis we meet with an appearance to which Malpighi, who firſt deſcribed it, gave the name of *rete mucoſum*, ſuppoſing it to be of a membranous ſtructure, and pierced with an infinite number of pores; but the fact is, that it ſeems to be nothing more than a mucous ſubſtance which may be diſſolved by macerating it in water, while the cuticle and cutis preſerve their texture.

THE colour of the body is found to depend on the colour of this rete mucoſum, for in negroes it is obſerved to be perfectly black, whilſt the true ſkin is of the ordinary colour.

THE bliſters which raiſe the ſkin when burnt or ſcalded, are probably occaſioned by the rarefaction of this mucus.

## *Of the Cutis, or true Skin.*

The cutis is compoſed of fibres cloſely compacted together, as we may obſerve in leather which is the prepared ſkin of animals. Theſe fibres form a thick net-work, which every where admits the filaments of nerves, and an infinite number of blood-veſſels and lymphatics.

The cutis, when the epidermis is taken off, is found to have throughout its whole ſurface innumerable papillæ, which appear like very minute granulations, and ſeem to be calculated to receive the impreſſions of the touch, being the moſt eaſily obſerved where the ſenſe of feeling is the moſt delicate, as in the palms of the hands and on the fingers.

These papillæ are ſuppoſed by many anatomical writers to be continuations of the pulpy ſubſtance of nerves, whoſe coats have terminated in the cellular texture of the ſkin. The great ſenſibility of theſe papillæ evidently proves them to be exceedingly nervous; but ſurely the nervous fibrillæ of the ſkin are of them-

…mſelves ſcarcely equal to the formation of theſe papillæ, and it ſeems to be more probable that they are formed like the reſt of the cutis.

THESE papillæ being deſcribed, the uſes of the epidermis and the reticulum mucoſum will be more eaſily underſtood;—the latter ſerving to keep them conſtantly moiſt, while the former protects them from the external air, and modifies their too great ſenſibility.

## *Of the Glands of the Skin.*

IN different parts of the body we meet within the ſubſtance of the ſkin, with certain appearances, which ſeem to be nothing more than very ſmall cylindrical tubes or ſimple follicles, continued from the ends of arteries, and diſcharging a fat and oily humour that ſerves to lubricate and ſoften the ſkin—When this fluid is collected and long retained in theſe follicles, it inſpiſſates, and by enlarging the tubes, gives them the ſpherical appearance that has occaſioned them to be called glands: and when the fluid they ſecrete has acquired a certain degree of thickneſs, it approaches to the colour and conſiſtence of ſuet; and from this appearance they have derived their name of *ſebaceous* glands. They are found in the greateſt number in the axilla, groin, ſcrotum, vagina, and prepuce.

Besides theſe ſebaceous glands, we read, in anatomical books, of others that are deſcribed as ſmall ſpherical bodies placed in all parts of the ſkin, in much greater abundance than thoſe juſt now mentioned, and named *miliary*, from their ſuppoſed reſemblance to millet-ſeed. Steno, who firſt deſcribed theſe glands, and Malpighi, Ruyſch, Verheyen, Winſlow, and others, who have adopted his opinions on this ſubject, ſpeak of them as having excretory ducts, that open on the ſurface of the cuticle, and diſtil the ſweat and matter of inſenſible perſpiration; and yet, notwithſtanding the poſitive manner in which theſe pretended glands have been ſpoken of, we are now ſufficiently convinced that their exiſtence is altogether imaginary.

## *Of the Inſenſible Perſpiration, and Sweat.*

The matter of inſenſible perſpiration, or in other words, the ſubtile vapour that is continually exhaling from the ſurface of the body, is not ſecreted by any particular glands; but ſeems to be derived wholly from the extremities of the minute arteries that are every where diſperſed through the ſkin. Theſe exhaling veſſels are eaſily demonſtrated in the dead ſubject, by throwing water into the arteries; for then ſmall drops exſude from all parts of the ſkin, and raiſe up the cuticle, the pores of which are cloſed by death; and in the living ſubject, a looking-glaſs placed againſt the ſkin, is ſoon obſcured by the vapour. Bidloo fancied he had diſcovered ducts leading from the cutis to the cuticle, and tranſmitting this fluid; but in this he was miſtaken.

When the perſpiration is by any means increaſed, and ſeveral drops that were inſenſible when ſeparate, are united together and condenſed by the external air, they form upon the ſkin ſmall but viſible drops called *ſweat* *. This particularly happens after much exerciſe, or whatever occaſions an increaſed determination of fluids to the ſurface of the body; a greater quantity of perſpirable matter being in ſuch caſes carried through the paſſages that are deſtined to convey it off. It has been diſputed indeed, whether the inſenſible perſpiration and ſweat are to be conſidered as one and the ſame excretion, differing only in degree, or whether they are two diſtinct excretions derived from different ſources. In ſupport of the latter opinion, it has been alledged, that the inſenſible perſpiration is agreeable to nature, and eſſential to health, whereas ſweat may be conſidered as a ſpecies of diſeaſe. But this argument proves nothing, and it ſeems probable, that both the inſenſible vapor and the ſweat are exhaled in a ſimilar manner, though they differ in quantity, and probably in their qualities; the former being more limpid, and ſeemingly leſs impregnated with ſalts than the latter: at any rate we may conſider the ſkin as an emunctory through which the redundant water, and ſometimes the other more ſaline parts of the blood are carried off. But the inſenſible perſpiration is not confined to the ſkin only—a great part of what we are conſtantly throwing off in this way is from the lungs—The quantity of fluid exhaled from the human body by this inſenſible perſpiration is very conſiderable—Sanctorius (*k*) an Italian phyſician, who indefatigably paſſed a great many years in a ſeries of ſtatical experiments, demonſtrated long ago what has been confirmed by later obſervations, that the quantity of vapour exhaled from the ſkin and from the ſurface of the lungs, amounts nearly to 5-8ths of the aliment we take in. So that if in the warm climate of Italy a perſon eats and drinks the quantity of eight pounds in the courſe of a day, five pounds of it will paſs off by inſeſinble perſpiration, while three pounds only will be evacuated by ſtool, urine, ſaliva, &c.—But in

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* Leeuwenhoeck aſſerts that one drop of ſweat is formed by the conflux of fifteen drops of perſpirable vapour.

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(*k*) The inſenſible perſpiration is ſometimes diſtinguiſhed by the name of this phyſician, who was born in the territories of Venice, and was afterwards a profeſſor in the univerſity of Padua—after eſtimating the aliment he took in, and the ſenſible ſecretions and diſcharges, he was enabled to aſcertain with great accuracy the weight or quantity of inſenſible perſpiration by means of a ſtatical chair which he contrived for this purpoſe: and from his experiments, which were conducted with great induſtry and patience, he was led to determine what kinds of ſolid or liquid aliment increaſed or diminiſhed it—from theſe experiments he formed a ſyſtem, which he publiſhed at Venice in 1614, in the form of aphoriſms, under the title of "Ars de Medicina Statica."

countries where the degree of cold is greater than in Italy, the quantity of perſpired matter is leſs; in ſome of the more northern climates, it being found not to equal the diſcharge by urine—It is likewiſe obſerved to vary according to the ſeaſon of the year, and according to the conſtitution, age, ſex, diſeaſes, diet, exercife, paſſions, &c. of different people.

From what has been ſaid on this ſubject, it will be eaſily conceived, that this evacuation cannot be either much increaſed or diminiſhed in quantity without affecting the health.

The perſpirable matter and the ſweat, are in ſome meaſure analogous to the urine, as appears from their taſte and ſaline nature (*l*). And it is worthy of obſervation, that when either of theſe ſecretions is increaſed in quantity, the other is diminiſhed; ſo that they who perſpire the leaſt, uſually paſs the greateſt quantity of urine, and vice verſa,

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(*l*) Minute chryſtals have been obſerved to ſhoot upon the cloaths of men who work in glaſs-houſes.——*Haller. Elem. Phyſ.*

Of

## *Of the Nails.*

The nails are of a compact texture, hard and tranſparent like horn. Their orgin is ſtill a ſubject of diſpute. Malpighi ſuppoſed them to be formed by a continuation of the papillæ of the ſkin; Ludwig, on the other hand, maintained that they were compoſed of the extremities of blood-veſſels and nerves; both theſe opinions are now deſervedly rejected.

They ſeem to poſſeſs many properties in common with the cuticle; like it they are neither vaſcular nor ſenſible, and when the cuticle is ſeparated from the true ſkin by maceration or other means, the nails come away with it.

They appear to be compoſed of different layers, of unequal ſize, applied one over the other. Each layer ſeems to be formed of longitudinal fibres.

In each nail we may diſtinguiſh three parts, viz. the root, the body or middle, and the extremity.

tremity. The root is a ſoft, thin, and white ſubſtance, terminating in the form of a creſcent; the epidermis adheres very ſtrongly to this part; the body of the nail is broader, redder, and thicker, and the extremity is of ſtill greater firmneſs.

THE nails increaſe from their roots, and not from their upper extremity.

THEIR principal uſe is to cover and defend the ends of the fingers and toes from external injury.

## *Of the Hair.*

THE hairs, which from their being generally known, do not ſeem to require any definition, ariſe from diſtinct capſules or bulbs ſeated in the cellular membrane under the ſkin (*m*). Some of theſe bulbs incloſe ſeveral hairs

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(*m*) Malpighi, and after him the celebrated Ruyſch, ſuppoſed the hairs to be continuations of nerves, being of opinion that they originated from the papillæ of the ſkin, which they conſidered as nervous; and as a corroborating proof of what they advanced, they argued the pain we feel in plucking them out; but later anatomiſts ſeem to hairs—They may be obſerved at the roots of the hairs which form the beard or whiſkers of a cat.

The hairs, like the nails, grow only from below by a regular propulſion from their root, where they receive their nouriſhment—Their bulbs, when viewed with a microſcope are found to be of various ſhapes. In the head and ſcrotum they are roundiſh; in the eye-brows they are oval; in the other parts of the body they are nearly of a cylindrical ſhape. Each bulb ſeems to conſiſt of two membranes, between which there is a certain quantity of moiſture. Within the bulb the hair ſeparates into three or four fibrillæ—The bodies of the hairs, which are the parts without the ſkin, vary in ſoftneſs and colour according to the difference of climate, age, or temperament of body (*o*).

to have rejected this doctrine, and conſider the hairs as particular bodies, not ariſing from the papillæ (for in the parts where the papillæ abound moſt there are no hairs) but from bulbs or capſules, which are peculiar to them.

(*o*) The hairs likewiſe differ from each other, and may not be improperly divided into two claſſes; one of which may include the hair of the head, chin, pubes, and axillæ; and the other, the ſofter hairs, which are to be obſerved almoſt every where on the ſurface of the body.

Their general uſe in the body does not ſeem to be abſolutely determined, but hairs in particular parts, as on the eye-brows and eyelids, are deſtined for particular uſes, which will be mentioned when thoſe parts are deſcribed.

## *Of the cellular Membrane and Fat.*

The cellular membrane is found to inveſt the moſt minute fibres we are able to trace; ſo that by modern phyſiologiſts, it is very properly conſidered as the univerſal connecting medium of every part of the body.

It is compoſed of an infinite number of minute cells united together, and communicating with each other. The two diſeaſes, peculiar to this membrane, are proofs of ſuch a communication; for in the *emphyſema* all its cells are filled with air, and in the anaſarca they are univerſally diſtended with water. Beſides theſe proofs of communication from diſeaſe, a familiar inſtance of it may be obſerved amongſt butchers, who uſually puncture this membrane, and by inflating it with air, add to the good appearance of their meat.

The cells of this membrane ſerve as reſervoirs to the oily part of the blood or *fat*, which ſeems to be depoſited in them, either by tranſudation through the coats of the arteries that ramify through theſe cells, or by particular veſſels, continued from the end of arteries. Theſe cells are not of a glandular ſtructure, as Malpighi and others after him have ſuppoſed. The fat is abſorbed and carried back into the ſyſtem by the lymphatics. The great waſte of it in many diſeaſes, particularly in the conſumption, is a ſufficient proof that ſuch an abſorption takes place.

The fulneſs and ſize of the body, are in a great meaſure proportioned to the quantity of fat contained in the cells of this membrane.

In the living body it ſeems to be a fluid oil, which concretes after death. In graminivorous animals, it is found to be of a firmer conſiſtence than in man.

The fat is not confined to the ſkin alone, being met with every where in the interſtices of muſcles, in the omentum, about the kidnies, at the baſis of the heart, in the orbits, &c.

THE chief uſes of the fat ſeem to be to afford moiſture to all the parts with which it is connected; to facilitate the action of the muſcles; and to add to the beauty of the body, by making it every where ſmooth and equal.

# CHAP. III.

## *Of the* MUSCLES.

THE muſcles are the organs of motion. The parts that are uſually included under this name conſiſt of diſtinct portions of fleſh, ſuſceptible of contraction and relaxation; the motions of which in a natural and healthy ſtate, are ſubject to the will, and for this reaſon they are called *voluntary* muſcles. But beſides theſe, there are other parts of the body that owe their power of contraction to their muſcular fibres; thus the heart is of a muſcular texture, forming what is called a hollow muſcle; and the urinary bladder, ſtomach, inteſtines, &c. are enabled to act upon their contents, merely becauſe they are provided with muſcular fibres. Theſe are called *involuntary* muſcles, becauſe their motions are not dependent on the will. The muſcles of reſpiration, being in ſome meaſure influenced by the will, are ſaid to have a *mixed* motion.

The names by which the voluntary muſcles are diſtinguiſhed, are founded on their ſize, figure, ſituation, uſe, or the arrangement of their fibres, or their origin and inſertion. But beſides theſe particular diſtinctions, there are certain general ones that require to be noticed. Thus, if the fibres of a muſcle are placed parallel to each other in a ſtraight direction, they form what is ſtiled a *rectilinear* muſcle; if the fibres croſs and interſect each other, they conſtitute a *compound* muſcle; a *radiated* one, if the fibres are diſpoſed in the manner of rays; or a *penniform* muſcle, if, like the plume of a pen, they are placed obliquely with reſpect to the tendon.

Muscles that act in oppoſition to each other, are called *antagoniſtæ*; thus every extenſor or muſcle has a flexor for its antagoniſt, and *vice verſa*. Muſcles that concur in the ſame action are ſtiled *congeneres*.

The muſcles being attached to the bones, the latter may be conſidered as levers that are moved in different directions by the contraction of thoſe organs.

THAT end of a muſcle which adheres to the moſt fixed part is uſually called the *origin*, and that which adheres to the more moveable part the *inſertion* of the muſcle.

IN every muſcle we may diſtinguiſh two kinds of fibres ; the one, ſoft, of a red colour, ſenſible, and irritable, called fleſhy fibres ; the other of a firmer texture, of a white gliſtening colour, inſenſible, without irritability or the power of contracting, and named tendinous fibres. They are occaſionally intermixed, but the fleſhy fibres generally prevail in the belly or middle part of a muſcle, and the tendinous ones in the extremities. If theſe tendinous fibres are formed into a round ſlender chord, they form what is called the *tendon* of the muſcle; on the other hand, if they are ſpread into a broad flat ſurface, the extremity of the muſcle is ſtiled *aponeuroſis*.

THE tendons of many muſcles, eſpecially when they are long and expoſed to preſſure or friction in the grooves formed for them in the bones, are ſurrounded by a tendinous ſheath or *faſcia*, in which we ſometimes find a ſmall mucous ſac or *burſa mucoſa*, which obviates any inconvenience from friction. Sometimes we find whole muſcles, and even ſeveral muſcles covered by a faſcia of the ſame kind, that affords origin to many of their fibres, dipping down between them, adhering to the ridges of bones, and thus preventing them from ſwelling too much when in action. The moſt remarkable inſtance of ſuch a covering is the *faſcia lata* of the thigh.

Each muſcle is incloſed by a thin covering of cellular membrane, which has been ſometimes improperly conſidered as peculiar to the muſcles, and deſcribed under the name of *propria membrana muſculoſa*. This cellular covering dips down into the ſubſtance of the muſcle, connecting and ſurrounding the moſt minute fibres we are able to demonſtrate, and affording a ſupport to their veſſels and nerves.

Leeuwenhoeck fancied he had diſcovered, by means of his microſcope, the ultimate diviſion of a muſcle, and that he could point out the ſimple fibre, which appeared to him to be an hundred times leſs than a hair; but he was afterwards convinced how much he was miſtaken on this ſubject, and candidly acknowledged, that what he had taken for a ſimple fibre, was in fact a bundle of fibres.

It is eaſy to obſerve ſeveral of theſe faſciculi or bundles, in a piece of beef, in which, from the coarſeneſs of its texture, they are very evident.

The red colour which ſo particularly diſtinguiſhes the muſcular or fleſhy parts of animals, is owing to an infinite number of blood-veſſels that are diſperſed through their ſubſtance. When we macerate the fibres of a muſcle in water, it becomes of a white colour like all other parts of the body diveſted of their blood. The blood-veſſels are accompanied by nerves, and they are both diſtributed in ſuch abundance to theſe parts, that in endeavouring to trace the courſe of the blood-veſſels in a muſcle, it would appear to be formed altogether by their ramifications; and in an attempt to follow the branches of its nerves, they would be found to be in equal proportion.

If a muſcle is pricked or irritated, it immediately contracts. This is called its irritable principle, and this irritability is to be conſidered as the characteriſtic of muſcular fibres, and may ſerve to prove their exiſtence in parts that are too minute to be examined by the eye. This power, which diſpoſes the muſcles to contract when ſtimulated, independent of the will, is ſuppoſed to be inherent in them, and is therefore named *vis inſita.* This property is not to be confounded with elaſticity, which the membranes and other parts of the body poſſeſs in a greater or leſs degree in common with the muſcles; nor with ſenſibility, for the heart, though the moſt irritable, ſeems to be the leaſt ſenſible of any of the muſcular parts of the body.

After a muſcular fibre has contracted it ſoon returns to a ſtate of relaxation, till it is excited afreſh, and then it contracts and relaxes again. We may likewiſe produce ſuch a contraction, by irritating the nerve leading to a muſcle, although the nerve itſelf is not affected.

This principle is found to be greater in ſmall than in large, and in young than in old animals.

In the voluntary muſcles theſe effects of contraction and relaxation of the fleſhy fibres are produced in obedience to the will, by what may be called the *vis nervoſa*, a property that is not to be confounded with the *vis inſita* juſt now ſpoken of. The *vis nervoſa*, or operation of the mind, if we may ſo call it, by which a muſcle is brought into contraction, is not inherent in the muſcle like the *vis inſita*, neither is it perpetual, like this latter property. After long continued or violent exerciſe, for example, the voluntary muſcles become painful, and at length incapable of further action; whereas the heart and other involuntary muſcles, the motions of which depend ſolely on the *vis inſita*, continue through life in a conſtant ſtate of action, without any inconvenience, or waſte of this inherent principle.

The action of the vis nervoſa on the voluntary muſcles, conſtitutes what is called muſcular motion, a ſubject that has given riſe to a variety of hypotheſes, many of them ingenious, but none of them ſatisfactory.

Borelli and ſome others have undertaken to explain the cauſe of contraction, by ſuppoſing that every muſcular fibre forms as it were a chain of very minute bladders; while the nerves which are diſtributed through the muſcle, bring with them a ſupply of animal ſpirits, which at our will fill theſe bladders, and by increaſing their diameter in width, ſhorten them, and of courſe the whole fibre.

Borelli ſuppoſes theſe bladders to be of a rhomboidal ſhape; Bernouilli on the other hand contends that they are oval. Our countryman, Cowper, fancied he had filled them with mercury; the cauſe of this miſtake was probably owing to the mercury's inſinuating itſelf into ſome of the lymphatic veſſels (*a*).

We know that the muſcular fibre is ſhortened, and that the muſcle itſelf ſwells when in action, but how theſe phænomna are produced, we are unable to determine. We likewiſe know that the nerves are eſſential to muſcular

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(*a*) Mr. Elliott, an ingenious phyſiologiſt, has lately undertaken to account for the phænomena of muſcular motion on principles very different from thoſe juſt now mentioned. He ſuppoſes that a dephlogiſticated ſtate of the blood is requiſite for muſcular action, and that a communication of phlogiſton to the blood is a neceſſary effect of ſuch action.

cular motion, for upon dividing or making a ligature round the nerve leading to a muſcle, the latter becomes incapable of motion. A ligature made on the artery of a muſcle produces a ſimilar effect, a proof this, that a regular ſupply of blood is alſo equally neceſſary to muſcular motion. The cauſe of palſy is uſually not to be ſought for in the muſcle affected, but in the nerve leading to that muſcle, or in that part of the brain or ſpinal-marrow from which the nerve derives its origin.

## *Of the particular Muſcles.*

It would be inconſiſtent with the plan of an elementary work like this, to enter into a minute deſcription of all the muſcles. I ſhall therefore content myſelf with aſſiſting the memory of the ſtudent by the following table, in which he will find the name, origin, inſertion, and principal uſe of each muſcle deſcribed in few words, and occaſionally its etymology when it is of Greek derivation or difficult to be underſtood. Latin names that apply to the ſhape, direction, ſituation, origin, inſertion, ſize, or uſe of the ſeveral muſcles, ſeem to require no explanation.

# A TABLE* of the MUSCLES.

| | *Name.* | *Origin.* | *Inſertion.* | *Uſe.* |
|---|---|---|---|---|
| MUSCLES ſituated under the integuments of the cranium - | 1. OCCIPITO-FRONTALIS. | From the tranſverſe ridge of the os occipitis. | Into the ſkin of the eye-brows. | To pull the ſkin of the head backwards, and to raiſe the eye-brows, and ſkin of the fore-head. |
| | 2. CORRUGATOR SUPERCILII. | From above the joining of the os frontis, os naſi, and os maxillare. | Into the inner part of the occipito-frontalis. | To draw the eye-brows towards each other, and to wrinkle the forehead. |
| ——— of the eye-lids - - | 1. ORBICULARIS PALPEBRARUM. | From around the edge of the orbit. | Into the naſal proceſs of the os maxillare. | To ſhut the eye. |
| | 2. LEVATOR PALPEBRÆ SUPERIORIS. | From the bottom of the orbit, near the optic foramen. | Into the cartilage of the upper eye-lid. | To open the eye. |

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* In this table the muſcles are arranged according to their ſituation, but it does not include all the muſcles of the body, thoſe belonging to the eyes, internal ear, inteſtinum rectum, and the male and female organs of generation being deſcribed in other parts of the work. The reader will be pleaſed to obſerve likewiſe, that although all the muſcles, (a few only excepted) are in pairs, mention is here made only of the muſcles of one ſide.

| | Name. | Origin. | Inſertion. | Uſe. |
|---|---|---|---|---|
| MUSCLES of the external ear - | 1. ATTOLLENS AURICULAM. | From the tendon of the occipito frontalis near the os temporis. | Into the upper part of the ear. | To raiſe the ear. |
| | 2. ANTERIOR AURICULÆ. | From near the back part of the zygoma. | Into an eminence behind the helix. | To raiſe this eminence, and to pull it forwards. |
| | 3. RETRAHENTES * AURICULÆ. | From the outer and back part of the root of the maſtoid proceſs. | Into the convex part of the concha. | To ſtretch the concha, and pull the ear backwards. |
| ——— of the cartilages of the ear - - | 1. TRAGICUS. | From the outer and middle part of the concha, near the tragus. | Into the upper part of the tragus. | To depreſs the concha, and pull the point of the tragus a little outwards. |
| | 2. ANTI-TRAGICUS. | From the root of the inner part of the helix. | Into the upper part of the anti-tragus. | To dilate the mouth of the concha. |

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[*] Theſe are three ſmall ſlender muſcles. The inferior one is ſometimes wanting.

3. TRANS-

| | Name. | Origin. | Inſertion. | Uſe. |
|---|---|---|---|---|
| | 3. TRANSVERSUS-AURICULÆ. | From the upper part of the concha. | Into the inner part of the helix. | To ſtretch the concha and ſcapha, and likewiſe to pull the parts it is connected with, towards each other. |
| | 4. HELICIS MAJOR. | From the upper, anterior, and acute part of the helix. | Into the cartilage of the helix, a little above the tragus. | To depreſs the upper part of the helix. |
| | 5. HELICIS MINOR. | From the lower and fore part of the helix. | Into the helix, near the fiſſure in its cartilage. | To contract the fiſſure. |
| MUSCLES of the noſe - - - | 1. COMPRESSOR † NARIS. | From the outer part of the root of the ala naſi | Into the naſal proceſs of the os maxillare, and anterior extremity of the os naſi. | To ſtraighten the noſtrils, and likewiſe to corrugate the ſkin of the noſe. |

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† The noſe is affected by fibres of the occipito frontalis, and by ſeveral muſcles of the face, but this pair, the compreſſores, is the only one that is proper to it.

MUSCLES

| | Name. | Origin. | Inſertion. | Uſe. |
|---|---|---|---|---|
| Muscles of the mouth and lips | 1. Levator labii superioris, alæque nasi. | From the outer part of the orbitar proceſs of the os maxillare, and from the naſal proceſs of that bone, where it joins the os frontis. | Into the upper lip and ala of the noſe. | To draw the upper lip and ſkin of the noſe upwards and outwards. |
| | 2. Levator anguli oris. | From the os maxillare ſuperius, between the orbitar foramen and the firſt dens molaris. | Into the orbicularis oris at the angle of the mouth. | To raiſe the corner of the mouth. |
| | 3. Zygomaticus major. | From the os malæ, near the zygmaotic ſuture. | Into the angle of the mouth. | To inflate the cheek and raiſe the angle of the mouth. |
| | 4. Zygomaticus minor. | Immediately above the origin of the zyg. major. | Into the angle of the mouth. | To raiſe the angle of the mouth, obliquely outwards. |

| *Name.* | *Origin.* | *Inſertion.* | *Uſe.* |
|---|---|---|---|
| 5. BUCCINATOR. | From the alveoli of the dentes molares in the upper and lower jaws. | Into the angle of the mouth. | To contract the mouth, and draw the angle of it outwards and backwards. |
| 6. DEPRESSOR LABII SUPERIORIS, ALÆQUE NASI. | From the os maxill. ſuper. immediately above the gums of the dentes inciſores. | Into the root of the ala naſi and upper lip. | To draw the ala naſi and upper lip downwards. |
| 7. DEPRESSOR ANGULI ORIS. | At the ſide of the chin from the lower edge of the maxilla inferior. | Into the angle of the mouth. | To draw the corner of the mouth downwards. |
| 8. DEPRESSOR LABII INFERIORIS. | From the lower and anterior part of the maxilla inferior. | Into the under lip. | To draw the under lip downwards and ſomewhat outwards. |
| 9. LEVATOR LABII INFERIORIS. | From near the gums of the inciſores and caninus of the maxilla inferior. | Into the under lip and ſkin of the chin. | To raiſe the under lip and ſkin of the chin. |

10. ORBI-

| | *Name.* | *Origin.* | *Inſertion.* | *Uſe.* |
|---|---|---|---|---|
| | 10. ORBICULARIS *. | | | To ſhut the mouth by conſtringing the lips. |
| MUSCLES of the lower jaw - - | 1. TEMPORALIS. | From part of the os bregmatis and os frontis; ſquamous part of the os temporis; back part of the os malæ, and the temporal proceſs of the os ſphenoides †. | Into the coronoid proceſs of the lower jaw. | To move the lower jaw upwards. |
| | 2. MASSETER ‡. | From the malar proceſs of the os maxillare, and the lower edges | Into the baſis of the coronoid proceſs, and that part of the jaw which | To raiſe, and likewiſe to move the jaw a little forwards and backwards. |

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[*] This muſcle is in a great meaſure, if not wholly, formed by the buccinator, zygomatici, depreſſores and other muſcles that move the lips. Its fibres ſurround the mouth like a ring.

[†] Some of its fibres likewiſe have their origin from a ſtrong faſcia that covers the muſcle and adheres to the bone round the whole circumference of its origin. When we remove this covering, we find the muſcle of a ſemicircular ſhape with its radiated fibbres, converging and forming a ſtrong middle tendon.

[‡] So called from its uſe in chewing, its derivation being from *μασισάομαι*, *manduco*, to eat.

| *Name.* | *Origin.* | *Inſertion.* | *Uſe.* |
|---|---|---|---|
| | of the os malæ, and of the zygomatic proceſs of the os temporis. | ſupports that and the condyloid proceſs. | |
| 3. Pterygoideus internus. | From the inner ſurface of the outer wing of the pterygoid proceſs of the os ſphenoides, and from the proceſs of the os palati that helps to form the pterygoid foſſa. | Into the lower jaw on its inner ſide and near its angle. | To raiſe the lower jaw, and draw it a little to one ſide. |
| 4. Pterygoideus externus. | From the external ala of the pterygoid proceſs, a ſmall part of the adjacent os maxillare, and a ridge in the temporal | Into the fore part of the condyloid proceſs of the lower jaw, and likewiſe of the capſular ligament. | To move the jaw forwards and to the oppoſite ſide ‡; and at the ſame time to prevent the ligament of the joint from being pinched. |

‡ This happens when the muſcle acts ſingly. When both act, the jaw is brought horizontally forwards.

| | Name. | Origin. | Inſertion. | Uſe. |
|---|---|---|---|---|
| | | proceſs of the os ſphenoides. | | |
| Muscles ſituated at the fore part of the neck - - - - | 1. Latissimus colli *. | From the cellular membrane covering the pectoral; deltoid, and trapezius muſcles. | Into the ſide of the chin, and integuments of the cheek. | To draw the cheeks and ſkin of the face downwards. |
| | 2. Mastoideus †. | From the upper part of the ſternum, and from the upper and fore part part of the clavicle. | Into the maſtoid proceſs, and as far back as the lambdoidal ſuture. | To move the head to one ſide, or when both muſcles act, to bend it forwards. |

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* This broad and thin muſcular expanſion, which is ſituated immediately under the common integuments, is by Winſlow named *muſculus cutaneus*. Galen gave it the name of ϖλάτυσμα μυῶδες (*Platyſma-myoides*) the etymology of which is from ϖλατυσμὸς *dilatatio*, and μῦς, muſculus, and εἶδὸς, *forma*.

† This on account of its two origins is by Albinus deſcribed as two diſtinct muſcles, which he names *ſterno-maſtoideus* and *cleido-maſtoideus*.

| | *Name.* | *Origin.* | *Insertion.* | *Use.* |
|---|---|---|---|---|
| Muscles ſituated between the trunk and the os hyoides - - | 1. Costo-hyoideus ‡. | From the upper coſta of the ſcapula near its nitch; from part of a ligament that extends acroſs this nitch, and ſometimes by a few fibres, from the coracoid proceſs. | Into the baſis of the os hyoides. | To draw the os hyoides in an oblique direction downwards. |
| | 2. Sterno-hyoideus. | From the cartilage of the firſt rib, the inner and upper part of the ſternum, and a ſmall part of the clavicle. | Into the baſis of the os hyoides. | To draw the os hyoides downwards. |

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‡ As this muſcle does not always ariſe from the coracoid proceſs, it ſeems to have been improperly named *coraco-hyoides* by Douglas and Albinus. Winſlow callls it *omo-hyoideus*, on account of its general origin from the ſcapula.

3. Hyo-

| | *Name.* | *Origin.* | *Inſertion.* | *Uſe.* |
|---|---|---|---|---|
| | 3. Hyo-thyroideus. | From part of the baſis and horn of the os hyoides. | Into a rough oblique line at the ſide of the thyroid cartilage. | To raiſe the thyroid cartilage, or depreſs the os hyoides, |
| | 4. Sterno-thyroideus. | From between the cartilages of the 1ſt and 2d ribs, at the upper and inner part of the ſternum. | Immediately under the hyo-thyroideus. | To pull the thyroid cartilage downwards. |
| | 5. Crico-thyroideus. | From the anterior part and ſide of the cricoid cartilage. | Into the lower part and inferior horn of the thyroid cartilage. | To pull the cricoid cartilage upwards and backwards, or the thyroid forwards and downwards. |
| Muscles ſituated between the os hyoides and and lower jaw | 1. Digastricus *. | From a foſſa at the root of the maſtoid proceſs. | Into the lower and anterior part of the chin. | To draw the lower jaw downwards. |

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* From δὶς & γαϛὴρ (*biventer*) becauſe it has two fleſhy bellies with a middle tendon; this tendon paſſes through the ſtylo-hyoideus.

| *Name.* | *Origin.* | *Inſertion.* | *Uſe.* |
|---|---|---|---|
| 2. STYLO-HYOIDEUS †. | From the baſis of the ſtyloid proceſs. | Into the ſide and forepart of the os hyoides near its baſe. | To draw the os hyoides obliquely upwards. |
| 3. MYLO-HYOIDEUS ‡. | From the inſide of the lower jaw, between the laſt dens molaris and the chin. | Into the baſis of the os hyoides. | To move the os hyoides to either ſide, forwards or upwards. |
| 4. ‖GENIO-HYOIDEUS. | From the inſide of the chin. | Into the baſe of the os hyoides. | To move the os hyoides forwards or upwards. |
| 5. GENIO-GLOSSUS. | From the inſide of the chin. | Into the tongue and baſis of the os hyoides. | To move the tongue in various directions. |
| 6. CERATO-GLOSSUS §. | From the horn, baſis, and appendix of the os hyoides. | Into the tongue laterally. | To draw the tongue downwards and inwards. |

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† In ſome ſubjects we meet with another muſcle, which from its having nearly the ſame origin, inſertion, and uſed as this, has been named *ſtylo-hoideus alter*.

‡ So named from its ariſing near the dentes molares (*μύλοι*) and its being inſerted into the os hyoides.

‖ From *γένειόν*, *mentum*, the chin.

§ From *κέρας*, *cornu* & *γλῶσσα*, *lingua*, the tongue.

7. LINGUALIS.

| *Name.* | *Origin.* | *Inſertion.* | *Uſe.* |
|---|---|---|---|
| 7. LINGUALIS. | Laterally from the root of the tongue. | Into the extremity of the tongue. | To ſhorten the tongue and draw it backwards. |
| 8. STYLO-GLOSSUS. | From the ſtyloid proceſs, and ſometimes alſo from a ligament that extends from thence to the angle of the lower jaw. | Into the ſide of the tongue from the root to near its tip. | To move the tongue backwards and to one ſide. |
| 9. STYLO-PHARYNGÆUS. | From the baſis of the ſtyloid proceſs. | Into the ſide of the pharynx and poſterior part of the thyroid cartilage. | To raiſe the thyroid cartilage and pharynx, and likewiſe to dilate the latter. |
| 10. CIRCUMFLEXUS-PALATI. | From near the bony part of the Euſtachian tube, and from the ſpinous proceſs of the os ſphenoides. | Into the ſemilunar edge of the os palati and the velum pendulum palati *. | To dilate and draw the velum obliquely downwards. |

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* This muſcle in its courſe, forms a round tendon, which after paſſing over a kind of hook formed by the inner plate of the pterygoid proceſs of the ſphenoid bone, expands into a tendinous membrane.

| | *Name.* | *Origin.* | *Inſertion.* | *Uſe.* |
|---|---|---|---|---|
| | II. LEVATOR PALATI MOLLIS. | From the membranous part of the Euſtachian tube, and the extremity of the os petroſum. | Into the velum pendulum palati. | To pull the velum backwards. |
| MUSCLES ſituated about the fauces - - | I. PALATO-PHARYNGÆUS. | From the lower and anterior part of the cartilaginous extremity of the Euſtachian tube*; the tendinous expanſion of the circumflexus palati; and the velum pendulum palati near the baſis and back part of the uvula. | Into the upper and poſterior part of the thyroid cartilage. | To raiſe the pharynx and thyroid cartilage, or to pull the velum and uvula backwards and downwards. |

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* The few fibres that ariſe from the Euſtachian tube are deſcribed as a diſtinct muſcle by Albinus, under the name of *ſalpingo-pharyngæus*. They ſerve to dilate the mouth of the tube.

| | *Name.* | *Origin.* | *Inſertion.* | *Uſe.* |
|---|---|---|---|---|
| | 2. Constrictor Isthmi faucium. | From near the baſis of the tongue laterally. | Into the velum pendulum palati, near the baſis and fore part of the uvula. | To raiſe the tongue and draw the velum towards it ‡. |
| | 3. Azygos uvulæ. | From the end of the ſuture that unites the oſſa palati. | Into the extremity of the uvula. | To ſhorten the uvula, and bring it forwards and upwards. |
| Muscles at the back part of the pharynx - - - | 1. Constrictor pharyngis superior. | From the cuneiform proceſs of the occipital bone; the pterygoid proceſs of the os ſphenoides, and from each jaw near the | Into the middle of the pharynx. | To move the pharynx upwards and forwards, and to compreſs its upper part. |

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‡ This muſcle and the *palato-pharyngæus* likewiſe ſerve to cloſe the paſſage into the fauces, and to carry the food into the pharynx.

laſt

| | *Name.* | *Origin.* | *Inſertion.* | *Uſe.* |
|---|---|---|---|---|
| | | laſt dens molaris ‡, | | |
| | 2. CONSTRICTOR PHARYNGIS MEDIUS *. | From the horn and appendix of the os hyoides, and from the ligament that unites it with the thyroid cartilage. | Into the middle of the proceſſus cuneiformis of the occipital bone, about its middle and before the great foramen. | To draw the os hyoides and pharynx upwards, and to compreſs the latter. |
| | 3. CONSTRICTOR PHARYNGIS INFERIOR †. | From the cricoid and thyroid cartilages. | Into the middle of the pharynx. | To compreſs part of the pharynx. |
| MUSCLES about the glottis - - | 1. CRICO-ARYTÆNOIDEUS LATERALIS. | From the ſide of the cricoid cartilage. | Into the baſis of the arytænoid cartilage laterally. | To open the glottis. |

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‡ The three orders of fibres here mentioned, with a few others derived from the tongue, have given occaſion to Douglas to deſcribe them as four diſtinct muſcles, under the names of *cephalo-pharyngæus*, *mylo-pharyngæus* *ptery-pharyngæus*, and *gloſſo-pharyngæus*.

* Douglas makes two muſcles of this, the *hyo-pharyngæus*, and *ſyndeſmo-pharyngæus*.

† The *crico-pharyngæus*, and *thyro-pharyngæus* of Douglas.

| *Name.* | *Origin.* | *Inſertion.* | *Uſe.* |
|---|---|---|---|
| 2. CRICO-ARYTÆNOIDÆUS POSTICUS. | From the cricoid cartilage poſteriorly. | Into the baſis of the arytænoid cartilage poſteriorly. | To open the glottis. |
| 3. ARYTÆNOIDEUS MINOR. | From the baſis of one of the cartilaginæs arytænoideæ. | Near the extremity of the other arytænoid cartilage. | To draw the parts it is connected with towards each other. |
| 4. ARYTÆNOIDEUS MAJOR. | From one of the arytænoid cartilages laterally. | Into the other arytænoid cartilage laterally. | To ſhut the glottis. |
| 5. THYREO-ARYTÆNOIDEUS. | From the poſterior and under part of the thyroid cartilage. | Into the arytænoid cartilage. | To draw the arytænoid cartilage forwards. |
| 6. ARYTÆNO-EPIGLOTTIDEUS. | From the upper part of the arytænoid cartilage laterally. | Into the ſide of the epiglottis. | To move the epiglottis outwards. |
| 7. THYREO-EPIGLOTTIDEUS. | From the thyroid cartilage. | Into the ſide of the epiglottis. | To pull the epiglottis obliquely downwards*. |

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* When either this or the preceding muſcle acts with its fellow, the epiglottis is drawn directly downwards upon the glottis.

| | Name. | Origin. | Inſertion. | Uſe. |
|---|---|---|---|---|
| MUSCLES at the fore part of the neck, cloſe to the vertebræ - | 1. RECTUS CAPITIS INTERNUS MAJOR. | From the anterior extremities of the tranſverſe proceſſes of the five lowermoſt cervical vertebræ. | Into the fore part of the cuneiform proceſs of the os occipitis. | To bend the head forwards. |
| | 2 RECTUS CAPITIS INTERNUS MINOR. | From the anterior and upper part of the firſt cervical vertebra. | Near the baſis of the condyloid proceſs of the os occipitis. | To aſſiſt the laſt deſcribed muſcle. |
| | 3. RECTUS CAPITIS LATERALIS. | From the anterior and upper part of the tranſverſe proceſs of the firſt cervical vertebra. | Into the os occipitis, oppoſite to the ſtylo-maſtoid foramen. | To move the head to one ſide. |
| | 4. LONGUS COLLI. | Within the thorax, laterally from the bodies of the three uppermoſt | Into the ſecond cervical vertebra anteriorly. | To pull the neck to one ſide †. |

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† When both muſcles act, the neck is drawn directly forwards.

dorſal

| | *Name.* | *Origin.* | *Inſertion.* | *Uſe.* |
|---|---|---|---|---|
| | | dorſal vertebræ; from the baſis and fore part of the tranſverſe proceſſes of the firſt and ſecond dorſal vertebræ, and of the laſt cervical vertebra; and laſtly, from the anterior extremities of the tranſverſe proceſſes of the 6th, 5th, 4th, and 3d cervical vertebræ. | | |
| MUSCLES at the forepart of the abdomen - - | 1. OBLIQUUS EXTERNUS. | From the lower edges of the eight in- | Into the linea alba [*], oſſa pubis [†], | To compreſs and ſupport the viſcera, aſ- |

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[*] The linea alba is that tendinous expanſion which reaches from the cartilago enſiformis to the os pubis. It is formed by the interlacement of the tendinous fibres of the obliquė and tranſverſe muſcles, and on this account ſome anatomiſts have conſidered theſe as three digaſtric muſcles.

[†] A little above the pubis the tendinous fibres of this muſcle ſeparate from each other, ſo as to form an opening called the *ring* of the obliquus externus, and commonly, though improperly, the ring of the abdominal muſcles, there being no ſuch aperture either in the tranſverſalis or obliquus internus. This ring in the male ſubject affords a paſſage to the ſpermatic veſſels, and in the female to the round ligament of the uterus.

ferior

| *Name.* | *Origin.* | *Inſertion.* | *Uſe.* |
|---|---|---|---|
| | inferior ribs, near their cartilages. | and ſpine of the ilium ‡. | ſiſt in evacuating the fæces and urine, draw down the ribs, and bend the trunk forwards, or obliquely to one ſide. |
| 2. OBLIQUUS INTERNUS. | From the ſpinous proceſs of the three lowermoſt lumbar vertebræ, the back part of the os ſacrum, the ſpine of the ilium, and back part of Fallopius's ligament *. | Into the cartilages of all the falſe ribs, linea alba †, and fore-part of the pubis. | To aſſiſt the obliquus externus. |

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‡ From the anterior and upper ſpinous proceſs of the ilium this muſcle is ſtretched tendinous to the os pubis, and thus forms what is called by ſome *Fallopius*'s, and by others *Poupart*'s *ligament*. The blood-veſſels paſs under it to the thigh.

* From this part it detaches ſome fibres which extend downwards upon the ſpermatic chord, and form what is deſcribed as the *cremaſter* muſcle.

† The tendon formed by the upper part of this muſcle in its way to the linea alba is divided into two layers. The poſterior layer runs under, and the anterior one over the rectus muſcle.

3. TRANS-

| *Name.* | *Origin.* | *Inſertion.* | *Uſe.* |
|---|---|---|---|
| 3. TRANSVERSALIS. | From the cartilages of the ſeven inferior ribs; the tranſverſe proceſſes of the laſt dorſal, and 4 upper lumbar vertebræ; the inner part of Fallopius's ligament and the ſpine of the ilium. | Into the linea alba and cartilago enſiformis. | To compreſs the abdominal viſcera. |
| 4. RECTUS ABDOMINIS. | From the upper edge of the pubis and the ſymphyſis pubis. | Into the cartilages of the 5th, 6th, and 7th ribs, and the edge of the cartilago enſiformis *. | To compreſs the fore part of the abdomen, and to bend the trunk forwards. |

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* The fibres of the rectus are generally divided by three tendinous interſections. The two upper thirds of this muſcle paſſing between the tendinous layers of the obliquus internus, are incloſed as it were in a ſheath, but at its lower part we find it immediately contiguous to the peritonæum, the inferior portion of the tendon of the tranſverſalis paſſing over the rectus, and adhering to the anterior layer of the obliquus internus.

|  | *Name.* | *Origin.* | *Inſertion.* | *Uſe.* |
|---|---|---|---|---|
|  | 5. PYRAMIDALIS ‖. | From the anterior and upper part of the pubis. | Into the linea alba and inner edge of the rectus, commonly about two inches above the pubis. | To aſſiſt the lower portion of the rectus. |
| MUSCLES at the fore part of the thorax - - - - | 1. PECTORALIS. | From the cartilaginous ends of the 5th and 6th ribs; the ſternum, and anterior part of the clavicle. | Into the upper and inner part of the os humeri §. | To draw the arm forwards, or obliquely forwards. |
|  | 2. SUBCLAVIUS. | From the cartilage of the firſt rib. | Into the under ſurface of the clavicle. | To move the clavicle forwards and downwards, and to aſſiſt in raiſing the firſt rib. |

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‖ This muſcle is ſometimes wanting.

§ The fibres of this muſcle paſs towards the axilla in a folding manner, and with thoſe of the latiſſimus dorſi form the arm-pit.

| | *Name.* | *Origin.* | *Inſertion.* | *Uſe.* |
|---|---|---|---|---|
| | 3. SERRATUS * ANTICUS. | From the upper edges of the 3d, 4th, and 5th ribs. | Into the coracoid proceſs of the ſcapula. | To move the ſcapula forwards and downwards, or to elevate the ribs. |
| | 4. SERRATUS MAGNUS. | From the eight ſuperior ribs. | Into the baſis of the ſcapula. | To bring the ſcapula forwards. |
| MUSCLES that concur in forming the thorax | 1. DIAPHRAGMA §. | | | |
| | 2. LEVATORES COSTARUM. | From the tranſverſe proceſſes of the laſt cervical, and the eleven upper dorſal vertebræ. | Into the upper ſide of each rib, near its tuberoſity. | To move the ribs upwards and outwards. |
| | 3. INTERCOSTALES EXTERNI. | From the lower edge of each upper rib. | Into the ſuperior edge of each lower rib. | To elevate the ribs. |

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* This and ſome other muſcles derive their name of *ſerratus*, from their ariſing by a number of tendinous or fleſhy digitations, reſembling the teeth of a ſaw (*ſerra*).

§ For a deſcription of the diaphragm, ſee Chap. V. Sect. IV.

4. INTER-

| *Name.* | *Origin.* | *Inſertion.* | *Uſe.* |
|---|---|---|---|
| 4. INTERCOSTALES INTERNI ‡. | | | |
| 5. STERNO-COSTALES *. | From the cartilago enſiformis, lower and middle part of the ſternum, and from the cartilage of the 3d rib. | Into the cartilages of the 2d, 3d, 4th, 5th, and 6th ribs. | To depreſs the cartilages of the ribs. |

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‡ The origin, inſertion, and uſe of the internal intercoſtals are ſimilar to thoſe of the external. The reader, however, will be pleaſed to obſerve, that the intercoſtales externi occupy the ſpaces between the ribs only from the ſpine to their cartilages; from thence to the ſternum, there being only a thin membrane, which is ſpread over the intercoſtales interni; and that the latter on the contrary extend only from the ſternum to the angles of each rib.

The fibres of the external muſcles run obliquely forwards; thoſe of the internal obliquely backwards. This difference in the direction of their fibres induced Galen to ſuppoſe that they were intended for different uſes, that the external intercoſtals, for inſtance, ſerve to elevate, and the internal ones to depreſs the ribs. Fallopius ſeems to have been the firſt who ventured to diſpute the truth of this doctrine, which has ſince been revived by Boyle, and more lately ſtill by Hamberger, whoſe theoretical arguments on this ſubject have been clearly refuted by the experiments of Haller.

* Theſe conſiſt of four, and ſometimes five diſtinct muſcles on each ſide. Veſalius, and after him Douglas and Albinus, conſider them as forming a ſingle muſcle, which, on account of its ſhape, they name *triangularis*. Verheyen, Winſlow, and Haller, more properly deſcribe them as ſo many ſeparate muſcles, which, on account of their origin and inſertion, they name *ſterno-coſtales*.

| | *Name.* | *Origin.* | *Inſertion.* | *Uſe.* |
|---|---|---|---|---|
| Muscles at the back part of the neck and trunk - - - - | 1. Trapezius §, or cucullaris. | From the middle of the os occipitis, and the ſpinous proceſſes of the two inferior cervical, and of all the dorſal vertebræ ‡. | Into the poſterior half of the clavicle, part of the acromion, and the ſpine of the ſcapula. | To move the ſcapula, neck and head. |
| | 2. Rhomboideus ‖. | From the ſpinous proceſſes of the three lowermoſt cervical, and of all the dorſal vertebræ. | Into the baſis of the ſcapula. | To move the ſcapula upwards and backwards. |

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§ So named by Riolanus, from τράπεζα, on account of its quadrilateral ſhape. Columbus and others give it the name of *cucullaris*, from its reſemblance to a monk's hood.

‡ The tendinous fibres of this muſcle, united with thoſe of its fellow, in the nape of the neck, from what is called the *ligamentum colli.*

‖ This muſcle conſiſts of two diſtinct portions, which are deſcribed as ſeparate muſcles by Albinus, under the names of *rhomboideus minor*, and *rhomboideus major.*

3. Latis-

| *Name.* | *Origin.* | *Inſertion.* | *Uſe.* |
|---|---|---|---|
| 3. LATISSIMUS DORSI. | From part of the ſpine of the os ilium, the ſpinous proceſſes of the os ſacrum and lumbar vertebræ, and of ſix or eight of the dorſal vertebræ; alſo from the four inferior falſe ribs near their cartilages. | Into the os humeri, between its two tuberoſities. | To draw the os humeri downwards and backwards, and to roll it upon its axis. |
| 4. SERRATUS INFERIOR POSTICUS. | From the ſpinous proceſſes of the two lowermoſt dorſal, and of three of the lumbar vertebræ. | Into the lower edges of the three or four lowermoſt ribs near their cartilages. | To draw the ribs outwards, downwards, and backwards. |
| 5. LEVATOR SCAPULÆ. | From the tranſverſe proceſſes of the four uppermoſt vertebræ colli. | Into the upper angle of the ſcapula. | To move the ſcapula forwards and upwards. |

| *Name.* | *Origin.* | *Inſertion.* | *Uſe.* |
|---|---|---|---|
| 6. SERRATUS SUPERIOR POSTICUS. | From the lower part of the ligamentum colli, the ſpinous proceſs of the lowermoſt cervical vertebra, and of the two ſuperior dorſal vertebræ. | Into the 2d, 3d, and 4th ribs. | To expand the thorax. |
| 7. SPLENIUS *. | From the ſpinous proceſſes of the four or five uppermoſt vertebræ of the back, and of the lowermoſt cervical vertebra. | Into the tranſverſe proceſſes of the two firſt cervical vertebræ, the upper and back part of the maſtoid proceſs, and a ridge on the os occipitis. | To move the head backwards. |

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* According to ſome writers, this muſcle has gotten its name from its reſemblance to the ſpleen; others derive it from *ſplenium* a *ſplint.*

| *Name.* | *Origin.* | *Inſertion.* | *Uſe.* |
|---|---|---|---|
| 8. COMPLEXUS §. | From the tranſverſe proceſſes of the four or five uppermoſt dorſal, and of the ſix lowermoſt cervical vertebræ. | Into the os occipitis. | To draw the head backwards. |
| 9. TRACHELOMASTOIDEUS ‖. | From the tranſverſe proceſſes of the firſt dorſal vertebra, and four or five of the lowermoſt cervical vertebræ. | Into the maſtoid proceſs. | To draw the head backwards. |
| 10. RECTUS CAPITIS POSTICUS MAJOR. | From the ſpinous proceſs of the ſecond cervical vertebra. | Into the os occipitis. | To extend the head and draw it backwards. |
| 11. RECTUS CAPITIS POSTICUS MINOR. | From the firſt vertebra of the neck. | Into the os occipitis. | To aſſiſt the rectus major. |

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§ So named on account of its complicated ſtricture.

‖ So named from its origin from the neck (τραιχηλὸς) and its inſertion into the maſtoid proceſs.

12. OBLIQUUS

| *Name.* | *Origin.* | *Inſertion.* | *Uſe.* |
|---|---|---|---|
| 12. OBLIQUUS SUPERIOR CAPITIS. | From the tranſverſe proceſs of the firſt cervical vertebra. | Into the os occipitis. | To draw the head backwards. |
| 13. OBLIQUUS INFERIOR CAPITIS. | From the ſpinous proceſs of the ſecond cervical vertebra. | Into the tranſverſe proceſs of the 1ſt cervical vertebra. | To draw the face towards the ſhoulder, and to move the firſt vertebra upon the ſecond. |
| 14. SACRO-LUMBALIS †. | From the back part of the os ſacrum, ſpine of the ilium, ſpinous proceſſes, and roots of the tranſverſe proceſſes of the vertebræ of the loins. | Into the lower edge of each rib. | To draw the ribs downwards, move the body upon its axis, aſſiſt in erecting the trunk, and turn the neck backwards, or to one ſide. |

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† Several thin faſcculi of fleſhy fibres ariſe from the lower ribs, and terminate in the inner ſide of this muſcle. Steno names them *muſculi ad ſacro lumbalem acceſſorii.* The ſacro lumbalis likewiſe ſends off a fleſhy ſlip from its upper part, which by Douglas and Albinus is deſcribed as a diſtinct muſcle, under the name of *cervicalis deſcendens.* Morgagni has very properly conſidered it as a part of the ſacro lumbalis.

| *Name.* | *Origin.* | *Inſertion.* | *Uſe.* |
|---|---|---|---|
| 15. LONGISSIMUS DORSI §. | The ſame as that of the ſacro lumbalis. | Into the tranſverſe proceſſes of the dorſal vertebræ. | To ſtretch the vertebræ of the back, and keep the trunk erect. |
| 16. SPINALIS DORSI. | From the ſpinous proceſſes of the uppermoſt lumbar, and lowermoſt dorſal vertebræ. | Into the ſpinous proceſſes of the nine ſuperior dorſal vertebræ. | To extend the vertebræ. |
| 17. SEMI-SPINALIS DORSI. | From the tranſverſe proceſſes of the 7th, 8th, 9th and 10th vertebræ of the back. | Into the ſpinous proceſſes of the four uppermoſt dorſal, and lowermoſt of the cervical vertebræ. | To extend the ſpine obliquely backwards. |

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§ At the upper part of this muſcle a broad thin layer of fleſhy fibres is found croſſing, and intimately adhering to it. This portion, which is deſcribed by Albinus, under the name of *tranſverſalis cervicis*, may very properly be conſidered as an appendage to the longiſſimus dorſi. It ariſes from the tranſverſe proceſſes of the five or ſix ſuperior dorſal vertebræ, and is inſerted into the tranſverſe proceſſes of the ſix inferior cervical vertebræ. By means of this appendage the longiſſimus dorſi may ſerve to move the neck to one ſide, or obliquely backwards.

18. MULTIFIDUS

| *Name.* | *Origin.* | *Inſertion.* | *Uſe.* |
|---|---|---|---|
| 18. MULTIFIDUS SPINÆ \|\|. | From the os ſacrum, ilium, oblique and tranſverſe proceſſes of the lumbar vertebræ, tranſverſe proceſſes of the dorſal, and four of the cervical vertebræ. | Into the ſpinous proceſſes of the lumbar, dorſal, and ſix of the cervical vertebræ. | To extend the back and draw it backwards, or to one ſide. |
| 19. SPINALIS CERVICIS. | From the tranſveſe proceſſes of the five or ſix uppermoſt dorſal vertebræ. | Into the ſpinous proceſſes of the 2d, 3d, 4th, 5th, and 6th cervical vertebræ. | To ſtretch the neck obliquely backwards. |

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|| Anatomiſts in general have unneceſſarily multiplied the muſcles of the ſpine. Albinus has the merit of having introduced greater ſimplicity into this part of myology. Under the name of *multifidus ſpinæ*, he has very properly included thoſe portions of muſcular fleſh intermixed with tendinous fibres, ſituated cloſe to the back part of the ſpine, and which are deſcribed by Douglas, under the names of *tranſverſales colli, dorſi & lumborum.*

| *Name.* | *Origin.* | *Inſertion.* | *Uſe.* |
|---|---|---|---|
| 20. SCALENUS *. | From the tranſverſe proceſſes of the five inferior cervical vertebræ. | Into the upper and outer part of the firſt and ſecond ribs. | To move the neck forwards, or to one ſide. |
| 21. INTER-SPINALES †. | From between the ſpinous proceſſes of the ſix inferior cervical vertebræ. | Into the ſpinous proceſſes of the vertebræ above. | To draw the ſpinous proceſſes towards each other. |
| 22. INTER-TRANSVERSALES §. | From between the tranſvervſe proceſſes of the vertebræ. | Into the tranſverſe proceſſes of the vertebræ above. | To draw the tranſverſe proceſſes towards each other. |

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[*] The ancients gave it this name from its reſemblance to an irregular triangle (σϰαληνὸς.) It conſiſts of three fleſhy portions. The anterior one affords a paſſage to the axillary artery, and between this and the middle portion we find the nerves going to the upper extremities. The middle is in part covered by the poſterior portion, which is the longeſt and thinneſt of the three.

[†] In the generality of anatomical books, we find theſe muſcles divided into *inter-ſpinales cervicis, dorſi,* and *lumborum,* but we do not find any ſuch muſcles either in the loins or back.

[§] Theſe muſcles are to be found only in the neck and loins; what have been deſcribed as the *inter-tranſverſales dorſi* being rather ſmall tendons than muſcles.

| | *Name.* | *Origin.* | *Inſertion.* | *Uſe.* |
|---|---|---|---|---|
| MUSCLES within the cavity of the abdomen, on the anterior and lateral parts of the ſpine - - - - | 1. PSOAS PARVUS ‖. | From the ſides and tranſverſe proceſſes of the uppermoſt lumbar vertebra, and ſometimes of the lowermoſt dorſal vertebra. | Into the brim of the pelvis, at the junction of the os pubis with the ilium. | To bend the loins forwards. |
| | 2. PSOAS MAGNUS. | From the bodies and tranſverſe proceſſes of the laſt dorſal, and all the lumbar vertebræ. | Into the os femoris, a little below the trochanter minor. | To bend the thigh forwards. |

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‖ This and the following pair of muſcles derive their name of *pſōas*, from ψόα, *lumbus*, on account of their ſituation at the anterior part of the loins.

| *Name.* | *Origin.* | *Inſertion.* | *Uſe.* |
|---|---|---|---|
| 3. ILIACUS INTERNUS. | From the inner lip, hollow part, and edge of the os ilium. | In common with the pſoas magnus. | To aſſiſt the pſoas magnus. |
| 4. QUADRATUS LUMBORUM ‡. | From the poſterior part of the ſpine of the ilium. | Into the tranſverſe proceſſes of the four uppermoſt lumbar vertebræ, the inferior edge of the laſt rib, and the ſide of the lowermoſt dorſal vertebra. | To ſupport the ſpine, or to draw it to one ſide. |
| 5. COCCYGÆUS. | From the poſterior and inner edge of the ſpine of the iſchium. | Into the lower part of the os ſacrum, and almoſt the whole length of the os coccygis laterally. | To draw the os coccygis forwards and inwards ‖. |

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‡ So called from its ſhape, which is that of an irregular ſquare.

‖ Some of the fibres of this muſcle are united with thoſe of the levator ani, ſo that it aſſiſts in cloſing the lower part of the pelvis.

| | *Name.* | *Origin.* | *Inſertion.* | *Uſe.* |
|---|---|---|---|---|
| MUSCLES on the ſcapula, and upper part of the os humeri | 1. DELTOIDES*. | From the clavicle, proceſſus acromion, and ſpine of the ſcapula. | Into the anterior and middle part of the os humeri. | To raiſe the arm. |
| | 2. SUPRA-SPINATUS. | From the baſis, ſpine, and upper coſta of the ſcapula. | Into a large tuberoſity at the head of the os humeri. | To raiſe the arm. |
| | 3. INFRA-SPINATUS. | From the baſis and ſpine of the ſcapula. | Into the upper and middle part of the tuberoſity. | To roll the os humeri outwards. |
| | 4. TERES MINOR §. | From the inferior coſta of the ſcapula. | Into the lower part of the tuberoſity. | To aſſiſt the infra ſpinatus. |
| | 5. TERES MAJOR. | From the inferior angle, and inferior coſta of the ſcapula. | Into the ridge at the inner ſide of the groove formed for the long | To aſſiſt in the rotatory motion of the arm. |

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[*] So named from its ſuppoſed reſemblance to the Greek Δ reverſed.

[§] This and the following pair are called *teres*, from their being of a long and round ſhape.

| | *Name.* | *Origin.* | *Insertion.* | *Use.* |
|---|---|---|---|---|
| | | | head of the biceps. | |
| | 6. Subscapularis. | From the baſis, ſuperior and inferior coſtæ of the ſcapula. | Into the upper part of a ſmall tuberoſity at the head of the os humeri. | To roll the arm inwards. |
| | 7. Coraco-brachialis ‖. | From the coracoid proceſs of the ſcapula. | Into the middle and inner ſide of the os humeri. | To roll the arm forwards and upwards. |
| Muscles on the os humeri - - | 1. Biceps brachii. | By two heads, one from the coracoid proceſs, and the other, or *long head*, from the upper and outer edge of the glenoid cavity of the ſcapula. | Into the tuberoſity at the upper end of the radius. | To bend the fore-arm. |

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‖ This muſcle affords a paſſage to the muſculo-cutaneous nerve.

| | *Name.* | *Origin.* | *Inſertion.* | *Uſe.* |
|---|---|---|---|---|
| | 2. BRACHIALIS INTERNUS. | From the os humeri, below, and at each ſide of the tendon of the deltoides. | Into a ſmall tuberoſity at the fore-part of the coronoid proceſs of the ulna. | To aſſiſt in bending the the fore-arm. |
| | 3. TRICEPS BRACHII. | By three heads; the firſt from the inferior coſta of the ſcapula; the ſecond, from the upper and outer part of the os humeri; and the third, from the back-part of that bone. | Into the upper and outer part of the olecranon. | To extend the fore-arm. |
| MUSCLES on the fore-arm - - - | 1. SUPINATOR LONGUS. | From the outer ridge and anterior ſurface of the os humeri, a little above its outer condyle. | Into the radius near its ſtyloid proceſs. | To aſſiſt in turning the palm of the hand upwards. |

| *Name.* | *Origin.* | *Inſertion.* | *Uſe.* |
|---|---|---|---|
| 2. EXTENSOR CARPI RADIALIS LONGUS. | Immediately below the origin of the ſupinator longus. | Into the upper part of the metacarpal bone of the fore-finger. | To extend the wriſt. |
| 3. EXTENSOR CARPI RADIALIS BREVIS. | From the outer and lower part of the outer condyle of the os humeri, and the upper part of the radius. | Into the upper part of the metacarpal bone of the middle-finger. | To aſſiſt the extenſor longus. |
| 4. EXTENSOR DIGITORUM COMMUNIS. | From the outer condyle of the os humeri. | Into the back part of all the bones of the four fingers. | To extend the fingers. |
| 5. EXTENSOR MINIMI DIGITI. | From the outer condyle of the os humeri. | Into the bones of the little finger. | To extend the little finger. |
| 6. EXTENSOR CARPI ULNARIS. | From the outer condyle of the os humeri. | Into the metacarpal bone of the little finger. | To aſſiſt in extending the wriſt. |

| *Name.* | *Origin.* | *Inſertion.* | *Uſe.* |
|---|---|---|---|
| 7. ANCONÆUS [‡]. | From the outer condyle of the os humeri. | Into the outer edge of the ulna. | To extend the fore-arm. |
| 8. FLEXOR CARPI ULNARIS. | From the inner condyle of the os humeri, and anterior edge of the olecranon [*]. | Into the os piſiforme. | To aſſiſt in bending the hand. |
| 9. PALMARIS LONGUS. | From the inner condyle of the os humeri. | Into the internal annular ligament, and aponeuroſis palmaris [§]. | To bend the hand. |
| 10. FLEXOR CARPI RADIALIS. | From the inner condyle of the os humeri. | Into the metacarpal bone of the fore-finger. | To bend the hand. |

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[‡] So called from ἀγκῶν, *cubitus.*

[*] Between the two origins of this muſcle we find the ulnor-nerve going to the fore-arm.

[§] The *aponeuroſis palmaris* is a tendinous membrane that extends over the palm of the hand. Some anatomiſts have ſuppoſed it to be a production of the tendon of this muſcle, but without ſufficient grounds, for in ſome ſubjects we find the palmaris longus inſerted wholly into the annular ligament, ſo as to be perfectly diſtinct from this aponeuroſis; and it now and then happens, that no palmaris longus is to be found, whereas this expanſion is never deficient.

| *Name.* | *Origin.* | *Inſertion.* | *Uſe.* |
|---|---|---|---|
| 11. PRONATOR TERES. | From the outer condyle of the os humeri, and coronoid proceſs of the ulna. | Into the anterior and convex edge of the radius, near its middle. | To roll the hand inwards. |
| 12. PERFORATUS ‖. | From the inner condyle of the os humeri, inner edge of the coronoid proceſs of the ulna, and upper and anterior part of the radius. | Into the ſecond bone of each finger. | To bend the ſecond joint of the fingers. |
| 13. SUPINATOR BREVIS. | From the outer condyle of the os humeri, and poſterior ſurface and outer edge of the ulna. | Into the anterior, inner, and upper part of the radius. | To roll the radius outwards. |

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‖ This muſcle is named *perforatus*, on account of the four tendons in which it terminates, being perforated by thoſe of another muſcle, the perforans.

14. ABDUCTOR

| *Name.* | *Origin.* | *Inſertion.* | *Uſe.* |
|---|---|---|---|
| 14. ABDUCTOR POLLICIS LONGUS. | From the middle and back part of the ulna, interoſſeous ligament, and radius. | By two tendons into the os trapezium, and firſt bone of the thumb. | To ſtretch the firſt bone of the thumb outwards. |
| 15. EXTENSOR MINOR POLLICIS. | From the back part of the ulna, and interoſſeous ligament and radius. | Into the convex part of the ſecond bone of the thumb. | To extend the ſecond bone of the thumb obliquely outwards. |
| 16. EXTENSOR MAJOR POLLICIS. | From the back of the ulna and interoſſeous ligament. | Into the third and laſt bone of the thumb. | To ſtretch the thumb obliquely backwards. |
| 17. INDICATOR. | From the middle of the ulna. | Into the metacarpal bone of the fore-finger. | To extend the fore-finger. |
| 18. PERFORANS. | From the upper and fore-part of the ulna, and interoſſeous ligament. | Into the fore-part of the laſt bone of each of the fingers. | To bend the laſt joint of the fingers. |

19. FLEXOR

| | *Name.* | *Origin.* | *Inſertion.* | *Uſe.* |
|---|---|---|---|---|
| | 19. FLEXOR LONGUS POLLICIS. | From the upper and fore-part of the radius. | Into the laſt joint of the thumb. | To bend the laſt joint of the thumb. |
| | 20. PRONATOR QUADRATUS. | From the inner and lower part of the ulna. | Into the radius, oppoſite to its origin. | To roll the radius inwards, and of courſe to aſſiſt in the pronation of the hand. |
| MUSCLES on the hand - - - - | 1. LUMBRICALES *. | From the tendons of the *perforans.* | Into the tendons of the extenſor digitorum communis. | To bend the firſt, and to extend the two laſt joints of the fingers §. |
| | 2. ABDUCTOR BREVIS POLLICIS. | From the fore-part of the internal annular ligament, os ſcaphoides, and one of the tendons of the abductor longus pollicis. | Into the outer ſide of the 2d bone of the thumb, near its root. | To move the thumb from the fingers. |

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* So named from their being ſhaped ſomewhat like the *lumbricus* or earth-worm.

§ Fallopius was the firſt who remarked the two oppoſite uſes of this muſcle. Their extending power is owing to their connection with the extenſor communis.

| *Name.* | *Origin.* | *Inſertion.* | *Uſe.* |
|---|---|---|---|
| 3. OPPONENS POLLICIS. | From the inner and anterior part of the internal annular ligament, and from the os ſcaphoides. | Into the firſt bone of the thumb. | To move the thumb inwards, and to turn it upon its axis. |
| 4. FLEXOR BREVIS POLLICIS. | From the os trapezoides, internal annular ligament, os magnum, and os unciforme. | Into the oſſa ſeſamoidea and ſecond bone of the thumb. | To bend the ſecond joint of the thumb. |
| 5. ADDUCTOR POLLICIS. | From the metacarpal bone of the middle finger. | Into the baſis of the ſecond bone of the thumb. | To move the thumb towards the fingers. |
| 6. ABDUCTOR INDICIS. | From the inner ſide of the firſt bone of the thumb, and from the os trapezium. | Into the firſt bone of the fore-finger poſteriorly. | To move the fore-finger towards the thumb. |
| . PALMARIS BREVIS. | From the internal annular liga- | Into the os piſiforme, and the | To contract the palm of the hand. |

| *Name.* | *Origin.* | *Inſertion.* | *Uſe.* |
|---|---|---|---|
| | ment, and aponeuroſis palmaris. | ſkin covering the abductor minimi digiti. | |
| 8. ABDUCTOR MINIMI DIGITI. | From the internal annular ligament and os piſiforme. | Into the ſide of the firſt bone of the little finger. | To draw the little finger from the reſt. |
| 9. FLEXOR PARVUS MINIMI DIGITI. | From the os unciforme and internal annular ligament. | Into the firſt bone of the little finger. | To bend the little finger. |
| 10. ADDUCTOR METACARPI MINIMI DIGITI. | From the os unciforme and internal annular ligament. | Into the metacarpal bone of the little finger. | To move that bone towards the reſt. |
| 11. INTEROSSEI INTERNI.<br>——— EXTERNI. | Situated between the metacarpal bones. | | To extend the fingers and move them towards the thumb †. |

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† The third interoſſeus internus (for there are four of the externi and three of the interni) differs from the reſt in drawing the middle finger from the thumb.

|  | *Name.* | *Origin.* | *Inſertion.* | *Uſe.* |
|---|---|---|---|---|
| MUSCLES at the back-part of the pelvis, and upper-part of the thigh - - - | 1. GLUTÆUS * MAXIMUS. | From the ſpine of the ilium, poſterior ſacro-iſchiatic ligaments, os ſacrum, and os coccygis. | Into the upper part of the *linea aſpera* of the os femoris. | To extend the thigh and aſſiſt in its rotatory motion. |
|  | 2. GLUTÆUS MEDIUS. | From the ſpine and ſuperior ſurface of the ilium. | Into the outer and back part of the great trochanter of the os femoris. | To aſſiſt the glutæus maximus. |
|  | 3. GLUTÆUS MINIMUS. | From the outer ſurface of the ilium and the border of its great niche. | Into the upper and anterior part of the great trochanter. | To aſſiſt the two former. |
|  | 4. PYRIFORMIS §. | From the anterior part of the os ſacrum. | Into a cavity at the root of the trochanter major. | To roll the thigh outwards. |

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* From γλȣτός, *nates.*

§ So named from its pear-like ſhape.

| *Name.* | *Origin.* | *Inſertion.* | *Uſe.* |
|---|---|---|---|
| 5. GEMINI ‖. | By two portions, one from the outer ſurface of the ſpine of the iſchium; the other from the tuberoſity of the iſchium, and poſterior ſacro-iſchiatic ligament. | Into the ſame cavity as the pyriformis. | To roll the thigh outwards, and likewiſe to confine the tendon of the obturator internus, when the latter is in action. |
| 6. OBTURATOR INTERNUS. | From the ſuperior half of the inner border of the foramen thyroideum. | Into the ſame cavity. | To roll the thigh outwards. |
| 7. QUADRATUS ‡ FEMORIS. | From the tuberoſity of the iſchium. | Into a ridge between the trochanter major and trochanter minor. | To move the thigh outwards. |

‖ The two portions of this muſcle having been deſcribed as two diſtinct muſcles by ſome anatomiſts, have occaſioned it to be named gemini. The tendon of the obturator internus, runs between theſe two portions.

‡ This muſcle is not of the ſquare ſhape its name would ſeem to indicate.

| | *Name.* | *Origin.* | *Inſertion.* | *Uſe.* |
|---|---|---|---|---|
| MUSCLES on the thigh † - - - | 1. BICEPS CRURIS. | By two heads; one from the tuberoſity of the iſchium, the other from the linea aſpera near the inſertion of the glutæus maximus. | Into the upper and back part of the fibula ‡. | To bend the leg. |
| | 2. SEMI-TENDINOSUS. | From the tuberoſity of the iſchium. | Into the upper and inner part of the tibia. | To bend and draw the leg inwards. |
| | 3. SEMI-MEMBRANOSUS §. | From the tuberoſity of the iſchium. | Into the upper and back part of the head of the tibia. | To bend the leg. |

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† The muſcles of the leg and thigh are covered by a broad tendinous membrane called *faſcia lata*, that ſurrounds them in the manner of a ſheath. It is ſent off from the tendons of the glutæi and other muſcles, and dipping down between the muſcles it covers, adheres to the linea aſpera, and ſpreading over the joint of the knee, gradually diſappears on the leg. It is thickeſt on the inſide of the thigh.

‡ The tendon of this muſcle forms the *outer ham-ſtring*.

§ So named on account of its origin, which is by a broad flat tendon three inches long.

| *Name.* | *Origin.* | *Inſertion.* | *Uſe.* |
|---|---|---|---|
| 4. TENSOR VAGINÆ FEMORIS. | From the ſuperior and anterior ſpinous proceſs of the ilium. | Into the inner ſide of the faſcia lata. | To ſtretch the faſcia. |
| 5. SARTORIUS. | From the ſuperior and anterior ſpinous proceſs of the ilium. | Into the upper and inner part of the tibia. | To bend the leg inwards *. |
| 6. RECTUS. | By two tendons; one from the anterior and inferior ſpinous proceſs of the ilium; the other from the poſterior edge of the cotyloid cavity. | Into the upper and fore-part of the patella. | To extend the leg. |
| 7. GRACILIS. | From the fore-part of the iſchium and pubis. | Into the upper and inner part of the tibia. | To bend the leg. |

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* Spigalius was the firſt who gave this the name of *ſartorius*, or the taylors muſcle, from its uſe in croſſing the legs.

| *Name.* | *Origin.* | *Inſertion.* | *Uſe.* |
|---|---|---|---|
| 8. Vastus externus †. | From the anterior and lower part of the great trochanter, and the outer edge of the linea aſpera. | To the upper and lateral part of the patella. | To extend the leg. |
| 9. Vastus internus. | From the inner edge of the linea aſpera, beginning between the fore-part of the os femoris and the root of the leſſer trochanter. | Into the upper and inner part of the patella. | To extend the leg. |
| 10. Cruræus ‡. | From the outer and anterior part of the leſſer trochanter: | Into the upper part of the patella. | To extend the leg. |

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† The vaſtus externus, vaſtus internus, and cruræus, are ſo intimately connected with each other, that ſome anatomiſts have been induced to conſider them as a *triceps*, or ſingle muſcle with three heads.

‡ Under the cruræus we ſometimes meet with two ſmall muſcles, to which Albinus has given the name of *ſub-cruræi*. They terminate on each ſide of the patella, and prevent the capſular ligament from being pinched. When they are wanting, which is very often the caſe, ſome of the fibres of the cruræus are found adhering to the capſula.

| *Name.* | *Origin.* | *Inſertion.* | *Uſe.* |
|---|---|---|---|
| 11. PECTINALIS. | From the anterior edge of the os pubis, or pectinis, as it is ſometimes called. | Into the upper and fore-part of the linea aſpera. | To bend the thigh. |
| 12. ADDUCTOR LONGUS FEMORIS †. | From the upper and fore-part of the os pubis. | Near the middle and back part of the linea aſpera. | To bend the thigh. |
| 13. ADDUCTOR BREVIS FEMORIS. | From the fore-part of the ramus of the os pubis. | Into the inner and upper part of the linea aſpera. | To bend the thigh and move it inwards. |
| 14. ADDUCTOR MAGNUS FEMORIS. | From the lower and fore-part of the ramus of the os pubis. | Into the whole length of the linea aſpera. | To move the thigh inwards and aſſiſt in bending it. |
| 15. OBTURATOR EXTERNUS. | From part of the obturator ligament, and the inner half of the circumference of | Into the os femoris near the root of the great trochanter. | To move the thigh outwards in an oblique direction, and likewiſe to bend and draw it inwards. |

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† This and the two following muſcles have been uſually, but improperly, conſidered as forming a ſingle muſcle with three heads, and on that account named *triceps femoris.*

| | *Name.* | *Origin.* | *Inſertion.* | *Uſe.* |
|---|---|---|---|---|
| | | the foramen thyroideum. | | |
| MUSCLES on the leg - - - - - | 1. GASTROCREMIUS [*] EXTERNUS. | By two heads; one from the inner condyle, the other from the outer condyle of the os femoris. | By a great round tendon, common to this and the following muſcle. | To extend the foot. |
| | 2. GASTROCREMUS [‡] INTERNUS. | By two heads; one from the back part of the head of the fibula, the other from the upper and back part of the tibia. | By a large tendon (the *tendo achillis*) common to this and the former muſcle, into the lower and back part of the os calcis. | To extend the foot. |

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[*] Γαστροκνημία; *ſura*, the calf of the leg.

[‡] This muſcle is by ſome anatomiſts named *ſoleus*, on account of its being ſhaped like the ſole-fiſh.

3. PLANTARIS

| *Name.* | *Origin.* | *Inſertion.* | *Uſe.* |
|---|---|---|---|
| 3. PLANTARIS §. | From the upper and poſterior part of the outer condyle of the os femoris. | Into the inſide of the back part of the os calcis. | To aſſiſt in extending the foot. |
| 4. POPLITEUS ‡. | From the outer condyle of the thigh. | Into the upper and inner part of the tibia. | To aſſiſt in bending the leg and rolling it inwards. |
| 5. FLEXOR LONGUS DIGITORUM PEDIS †. | From the upper and inner part of the tibia. | By four tendons, which after paſſing through the perforations in thoſe of the flexor digitorum brevis, are inſerted into the laſt bone of all the toes, except the great toe. | To bend the laſt joint of the toe. |

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§ This muſcle has gotten the name of *plantaris*, from its being ſuppoſed to furniſh the aponeuroſis that covers the ſole of the foot. But it does not in the leaſt contribute to the formation of that tendinous expanſion.

‡ So called on account of its ſituation at the ham (*poples.*)

† This muſcle, about the middle of the foot, unites with a fleſhy maſs, which from its having firſt been deſcribed by Sylvius, is uſually called *maſſa carnea* JACOBI SYLVII.

| *Name.* | *Origin.* | *Inſertion.* | *Uſe.* |
|---|---|---|---|
| 6. Flexor longus pollicis pedis. | From the back part and a little below the head of the fibula. | Into the laſt bone of the great toe. | To bend the great toe. |
| 7. Tibialis posticus. | From the back part and outer edge of the tibia, and likewiſe from the interoſſeous ligament and adjacent part of the fibula. | Into the inner and upper part of the os naviculare and ſide of the os cuneiforme medium. | To move the foot inwards. |
| 8. Peroneus longus. | From the outer ſide of the head of the tibia, and alſo from the upper anterior and outer part of the *perone* or fibula, to which it adheres for a conſiderable way down. | Into the metatarſal bone of the great toe. | To move the foot outwards. |

9. Peroneus

| *Name.* | *Origin.* | *Inſertion.* | *Uſe.* |
|---|---|---|---|
| 9. PERONEUS BREVIS. | From the outer and fore-part of the fibula. | Into the metatarſal bone of the little toe. | To aſſiſt the laſt deſcribed muſcle. |
| 10. EXTENSOR LONGUS DIGITORUM PEDIS. | From the upper, outer, and fore-part of the tibia, interoſſeous ligament, and inner edge of the fibula. | By four tendons into the firſt joint of the ſmaller toes. | To extend the toes. |
| 11. PERONEUS TERTIUS. | From the fore-part of the lower half of the fibula, and from the interoſſeous ligament. | Into the metatarſal bone of the little toe. | To bend the foot. |
| 12. TIBIALIS ANTICUS. | From the upper and fore-part of the tibia. | Into the os cuneiforme internum. | To bend the foot. |
| 13. EXTENSOR PROPRIUS POLLICIS PEDIS. | From the upper and fore-part of the tibia. | Into the convex ſurface of the bones of the great toe. | To extend the great toe. |

| | *Name.* | *Origin.* | *Inſertion.* | *Uſe.* |
|---|---|---|---|---|
| MUSCLES on the foot - - - - - | 1. EXTENSOR BREVIS DIGITORUM PEDIS. | From the upper and anterior part of the os calcis. | By four tendons, one of which joins the tendon of the externus longus pollicis, and the other three the tendons of the extenſor digitorum longus. | To extend the toes. |
| | 2. FLEXOR BREVIS DIGITORUM PEDIS. | From the lower part of the os calcis. | By four tendons, which after affording a paſſage to thoſe of the flexor longus, are inſerted into the ſecond phalanx of each of the ſmall toes. | To bend the ſecond joint of the toes. |
| | 3. ABDUCTOR POLLICIS PEDIS. | From the inner and lower part of the os calcis. | Into the firſt joint of the great toe. | To move the great toe from the other toes. |

| *Name.* | *Origin.* | *Inſertion.* | *Uſe.* |
|---|---|---|---|
| 4. ABDUCTOR MINIMI DIGITI. | From the outer tubercle of the os calcis, the root of the metatarſal bone of the little toe, and alſo from the aponeuroſis plantaris. | Into the outer ſide of the firſt joint of the little toe. | To draw the little toe outwards. |
| 5. LUMBRICALES PEDIS. | From the tendons of the flexor longus digitorum pedis. | Into the tendinous expanſion at the upper part of the toes. | To draw the toes inwards. |
| 6. FLEXOR BREVIS POLLICIS PEDIS. | From the inferior and anterior part of the os calcis, and alſo from the inferior part of the os cuneiforme externum. | By two tendons into the firſt joint of the great toe. | To bend the firſt joint of the great toe. |
| 7. ADDUCTOR POLLICIS PEDIS. | From near the roots of the metatarſal bones of the 2d, 3d, and 4th toes. | Into the outer os ſeſamoideum, or firſt joint of the great toe. | To draw the great toe nearer to the reſt, and alſo to bend it. |

8. TRANS-

| *Name.* | *Origin.* | *Inſertion.* | *Uſe.* |
|---|---|---|---|
| 8. TRANSVERSALES PEDIS. | From the outer and under part of the anterior end of the metatarſal bone of the little toe. | Into the inner os ſeſamoideum, and anterior end of the metatarſal bone of the great toe. | To contract the foot. |
| 9. FLEXOR BREVIS MINIMI DIGITI PEDIS. | From the baſis of the metatarſal bone of the little toe. | Into the firſt joint of the little toe. | To bend the little toe. |
| 10. INTEROSSEI PEDIS INTERNI †. | Situated between the metatarſal bones. | | |
| ——— EXTERNI ‡. | | | |

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† The interoſſei interni are three in number, their uſe is to draw the ſmaller toes towards the great toe.

‡ The interoſſei externi are four in number; the firſt ſerves to move the fore-toe towards the great toe; the reſt move the toes outwards. All the interoſſei aſſiſt in extending the toes.

CHAP.

## CHAP. IV.

### *Of the Abdomen, or Lower Belly.*

THE abdomen, or lower belly, extends from the lower extremity of the ſternum, or the hollow, uſually called the pit of the ſtomach, and more properly *ſcrobiculus cordis*, to the lower part of the trunk.

It is diſtinguiſhed into three diviſions called *regions*; of theſe the upper one, which is called the *epigaſtric region*, begins immediately under the ſternum, and extends to within two fingers breadth of the navel, where the middle or *umbilical region* begins, and reaches to the ſame diſtance below the navel. The third which is called the *hypogaſtric*, includes the reſt of the abdomen, as far as the os pubis.

Each of theſe regions is ſubdivided into three others; two of which compoſe the ſides, and the other the middle part of each region.

The middle part of the upper region is called epigaſtrium, and its two ſides hypochondria. The middle part of the next region is the umbilical region, properly ſo called, and its two ſides are the flanks, or iliac regions. Laſtly, the middle part of the lower region retains the name of hypogaſtrium, and its ſides are called inguina or groins. The back part of the abdomen bears the name of lumbar region.

These are the diviſions of the lower belly, which are neceſſary to be held in remembrance, as they frequently occur in ſurgical and anatomical writing. We will now proceed to examine the contents of the abdomen; and after having pointed out the names and arrangement of the ſeveral viſcera contained in it, deſcribe each of them ſeparately.

After having removed the ſkin, adipoſe membrane, and abdominal muſcles, we diſcover the peritonæum or membrane that envelops all the viſcera of the lower belly. This being opened, the firſt part that preſents itſelf is the omentum or cawl, floating on the ſurface of the inteſtines, which are likewiſe ſeen every where looſe and moiſt, and making a great number of circumvolutions through the whole cavity of the abdomen. The ſtomach is placed in the epigaſtrium, and under the ſtomach is the pancreas. The liver fills the right hypochondrium, and the ſpleen is ſituated in the left. The kidneys are ſeen about the middle of the lumbar region, and the urinary bladder and parts of generation are ſeated in the lower diviſion of the belly.

## SECTION I.

### *Of the Peritonæum.*

THE peritonæum is a ſtrong, ſimple membrane, by which all the viſcera of the abdomen are ſurrounded, and in ſome meaſure ſupported. Many anatomical writers, particularly Winſlow, have deſcribed it as being compoſed of two diſtinct membranous laminæ; but their deſcription ſeems to be erroneous. What perhaps appeared to be a ſecond lamina, being found to be ſimply a cellular coat, which ſends off productions to the blood-veſſels paſſing out of the abdominal cavity.

vity. The aorta and vena cava likewiſe derive a covering from the ſame membrane, which ſeems to be a part of the cellular membrane we have already deſcribed.

The peritonæum, by its productions and reduplications, envelops the greateſt part of the abdominal viſcera. It is ſoft, and capable of conſiderable extenſion; and is kept ſmooth and moiſt by a vapour, which is conſtantly exhaling from its inner ſurface, and is returned again into the circulation by the abſorbents.

This moiſture not only contributes to the ſoftneſs of the peritonæum, but prevents the attrition, and other ill effects which would otherwiſe probably be occaſioned, by the motion of the viſcera upon each other.

When this fluid is ſupplied in too great a quantity, or the abſorbents become incapable of carrying it off, it accumulates, and conſtitutes an aſcites or dropſy of the belly; and when by any means the exhalation is diſcontinued, the peritonæum thickens, becomes diſeaſed, and the viſcera are ſometimes found adhering to each other.

The peritonæum is not a very vaſcular membrane. In a ſound ſtate it ſeems to be endued with little or no feeling, and the nerves that paſs through it appear to belong to the abdominal muſcles.

## SECTION II.

### *Of the Omentum.*

THE omentum, epiploon, or cawl, is a double membrane, produced from the peritonæum. It is interlarded with fat, and adheres to the ſtomach, ſpleen, duodenum, and colon, from thence hanging down looſe and floating on the ſurface of the inteſtines. Its ſize is different in different ſubjects. In ſome it deſcends as low as the pelvis, and it is commonly longer at the left-ſide than the right.

This part, the ſituation of which we have juſt now deſcribed, was the only one known to the ancients under the name of *epiploon*, but at preſent we diſtinguiſh three omenta, viz. *omentum magnum colico gaſtricum*, *omentum parvum* *hepatico gaſtricum*, and *omentum colicum*. They all agree in being formed of two very delicate laminæ, ſeparated by a thin layer of cellular membrane.

THE omentum magnum colico gaſtricum, of which we have already ſpoken, derives its arteries from the ſplenic and hepatic. Its veins terminate in the vena portæ. Its nerves, which are very few, come from the ſplenic and hepatic plexus.

THE omentum parvum hepatico gaſtricum, abounds leſs with fat than the great epiploon. It begins at the upper-part of the duodenum, extends along the leſſer curvature of the ſtomach as far as the œſophagus, and terminates about the neck of the gall-bladder, and behind the left ligament of the liver, ſo that it covers the leſſer lobe; near the beginning of which we may obſerve a ſmall opening, firſt deſcribed by Winſlow, through which the whole pouch may eaſily be diſtended with air (*x*). The veſſels of the omentum parvum

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(*x*) This membranous bag, though exceedingly thin and tranſparent, is found capable of ſupporting mercury, thrown into it by the ſame channel.

are derived chiefly from the coronary ſtomachic arteries and veins.

The omentum colicum begins at the fore-part of the cœcum and right-ſide of the colon. It appears as a hollow, conical appendage to theſe inteſtines, and uſually terminates at the back of the omentum magnum. It ſeems to be nothing more than a membranous coat of the cœcum and colon, aſſuming a conical ſhape when diſtended with air.

The uſes of the omentum are not yet ſatisfactorily determined. Perhaps by its ſoftneſs and looſeneſs it may ſerve to prevent thoſe adheſions of the abdominal viſcera, which have been found to take place when the fat of the omentum has been much waſted. Some authors have ſuppoſed, that it aſſiſts in the preparation of bile; but this idea is founded merely on conjecture.

## SECTION III.

### *Of the Stomach.*

THE ſtomach is a membranous and muſcular bag, in ſhape not unlike a bagpipe, lying acroſs the upper-part of the abdomen, and inclining rather more to the left than the right-ſide.

IT has two orifices, one of which receives the end of the œſophagus, and is called the *cardia*, and ſometimes the left and upper orifice of the ſtomach; though its ſituation is not much higher than the other, which is ſtiled the right and inferior orifice, and more commonly the *pylorus ;* both theſe openings are more elevated than the body of the ſtomach.

THE aliment paſſes down the œſophagus into the ſtomach through the cardia, and after having undergone the neceſſary digeſtion, paſſes out at the pylorus where the inteſtinal canal commences.

THE ſtomach is compoſed of four tunics or coats, which are ſo intimately connected together, that it requires no little dexterity in the anatomiſt to demonſtrate them. The exterior one is membranous, being derived from the peritonæum.—The ſecond is a muſcular tunic, compoſed of fleſhy fibres which are in the greateſt number about the two orifices.—The third is called the nervous coat, and within this is the villous, or velvet-like coat which compoſes the inſide of the ſtomach.

The two laſt coats being more extenſive than the two firſt, form the folds, which are obſerved every where in the cavity of this viſcus, and more particularly about the pylorus; where they ſeem to impede the too haſty excluſion of the aliment, making a conſiderable plait, called *valvula pylori*.

The inner coat is conſtantly moiſtened by a mucus, which approaches to the nature of the ſaliva, and is called the gaſtric juice; this liquor is ſuppoſed to be ſecreted by certain minute glands (*y*) ſeated in the nervous tunic,

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(*y*) Heiſter ſpeaking of theſe glands very properly ſays, " in *porcis* facile, in *homine* raro obſervantur;" for although many anatomical writers have deſcribed their appearance and figure, yet they do not ſeem to have been hitherto ſatisfactorily demonſtrated in the human ſtomach.

whoſe excretory ducts open on the ſurface of the villous coat.

The arteries of the ſtomach called the gaſtric arteries, are principally derived from the cæliac; ſome of its veins paſs to the ſplenic, and others to the vena portæ; and its nerves are chiefly from the eighth pair or par vagum.

The account given of the tunics of the ſtomach, may be applied to the whole alimentary canal, for both the œſophagus and inteſtines are like this viſcus, compoſed of four coats.

Before we deſcribe the courſe of the aliment and the uſes of the ſtomach, it will be neceſſary to ſpeak of other parts which aſſiſt in the proceſs of digeſtion.

## SECTION IV.

### *Of the Oeſophagus.*

THE œſophagus or gullet, is a membranous and muſcular canal, extending from the bottom of the mouth to the upper orifice of the ſtomach—Its upper part where the aliment is received, is ſhaped ſomewhat like a funnel, and is called the *pharynx*.

From hence it runs down cloſe to the bodies of the vertebræ as far as the diaphragm, in which there is an opening through which it paſſes, and then terminates in the ſtomach about the eleventh or twelfth vertebra of the back.

The œſophagus is plentifully ſupplied with arteries from the external carotid, bronchial, and ſuperior intercoſtal arteries; its veins empty themſelves into the vena azygos, internal jugular, and mammary veins, &c.

Its nerves are derived chiefly from the eighth pair.

We likewiſe meet with a mucus in the œſophagus, which every where lubricates its inner ſurface, and tends to aſſiſt in deglutition.—This mucus ſeems to be ſecreted by very minute glands, like the mucus in other parts of the alimentary canal.

## SECTION V.

### *Of the Inteſtines.*

THE inteſtines form a canal, which is uſually ſix times longer than the body to which it belongs. This canal extends from the pylorus, or inferior orifice of the ſtomach to the anus.

It will be eaſily underſtood, that a part of ſuch great length, muſt neceſſarily make many circumvolutions, to be confined with ſo many other viſcera within the cavity of the lower belly.

Althgugh the inteſtines are in fact, as we have obſerved, only one long and extenſive canal, yet different parts have been diſtinguiſhed by different names.

The inteſtines are firſt diſtinguiſhed into two parts, one of which begins at the ſtomach, and is called the thin or ſmall inteſtines, from the ſmall ſize of the canal, when compared with the other part, which is called the large inteſtines, and includes the lower portion of the canal down to the anus.

Each of theſe parts has its ſubdiviſions.—The ſmall inteſtines being diſtinguiſhed into duodenum, jejunum and ileúm, and the larger portion into cœcum, colon and rectum.

The ſmall inteſtines fill the middle and fore-parts of the belly, while the large inteſtines fill the ſides and both the upper and lower parts of the cavity.

The *duodenum*, which is the firſt of the ſmall inteſtines, is ſo called, becauſe it is about twelve inches long.—It begins at the pylorus and terminates in the *jejunum*, which is a part of the canal obſerved to be uſually more empty than the other inteſtines.—This appearance gives it its name, and likewiſe ſerves to point out where it begins.

The next diviſion is the *ileum*, which of itſelf exceeds the united length of the duodenum and jejunum, and has received its name from its numerous circumvolutions. The large circumvolution of the ileum, covers the firſt of the large inteſtines called the *cœcum* (z), which ſeems properly to belong to the colon, being a kind of pouch of about four fingers in width, and nearly of the ſame length, having exteriorly a little appendix, called *appendix cœci.*

THE cœcum is placed in the cavity of the os ilium on the right-ſide, and terminates in the *colon*, which is the largeſt of all the inteſtines.

THIS inteſtine aſcends by the right kidney to which it is attached, paſſes under the hollow part of the liver, and the bottom of the ſtomach to the ſpleen, to which it is likewiſe ſecured, as it is alſo to the left kidney; and from thence paſſes down towards the os ſacrum, where, from its ſtraight courſe, the canal begins to take the name of *rectum.*

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(z) Anatomiſts have differed with reſpect to this diviſion of the inteſtines.—The method here followed is now generally adopted; but there are authors who allow the name of cœcum only to the little appendix, which has likewiſe been called the vermiform appendix, from its reſemblance to a worm in ſize and length.

There are three ligamentous bands extending through the whole length of the colon, which by being ſhorter than its two inner coats, ſerve to increaſe the plaits on the inner ſurface of this gut.

The *anus*, which terminates the inteſtinum rectum, is furniſhed with three muſcles; one of theſe is compoſed of circular fibres, and from its uſe in ſhutting the paſſage of the anus, is called *ſphincter ani*.

The other two are the *levatores ani*, ſo called, becauſe they elevate the anus after dejection. When theſe by palſy or any other diſeaſe loſe the power of contracting, the anus prolapſes; and when the ſphincter is affected by ſimilar cauſes, the fæces are voided involuntarily.

It has been already obſerved, that the inteſtinal canal is compoſed of four tunics; but it remains to be remarked, that here as in the ſtomach, the two inner tunics being more extenſive than the other two, form the plaits which are to be ſeen in the inner ſurface of the inteſtines, and are called *valvulæ conniventes*.

Some authors have conſidered theſe plaits as tending to retard the motion of the fæces, in order to afford more time for the ſeparation of the chyle; but there are others who attribute to them a different uſe: they contend, that theſe valves by being naturally inclined downwards, cannot impede the deſcent of the fæces, but that they are intended to prevent their return upwards.

They are probably deſtined for both theſe uſes; for although theſe folds incline to their lower ſide, yet the inequalities they occaſion in the canal are ſufficient to retard in ſome meaſure the progreſſive motion of the fæces, and to afford a greater ſurface for the abſorption of chyle, and their natural poſition ſeems to oppoſe itſelf to the return of the aliment.

Besides theſe *valvulæ convenientes*, there is one more conſiderable than the reſt, called the *valve of the colon*; which is found at that part of the canal, where the inteſtinum ileum is joined to the colon. This valve permits the alimentary pulp to paſs downwards, but ſerves to prevent its return upwards; and it is by this valve, that glyſters are prevented from paſſing into the ſmall inteſtines (*a*).

Of the little vermiform appendix of the cœcum, it will be ſufficient to ſay that its uſes have never yet been aſcertained.—In birds we meet with two of theſe appendices.

The inteſtines are lubricated by a conſtant ſupply of mucus, which is probably ſecreted by very minute follicles (*b*). This mucus promotes the deſcent of the alimentary pulp, and

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(*a*) This is not invariably the caſe, for the contents of a glyſter have been found not only to reach the ſmall inteſtines, but to be voided at the mouth. Such inſtances however are not common.

(*b*) Some writers have diſtinguiſhed theſe glands into miliary, lenticular, &c.—Brunner and Peyer were the firſt anatomiſts who deſcribed the glands of the inteſtines, and their deſcriptions were chiefly taken from animals, theſe glandular appearances not ſeeming to have been hitherto ſatisfactorily pointed out in the human ſubject.—It is now pretty generally believed, that the mucus which every where lubricates the alimentary canal, is exhaled from the minute ends of arteries; and that theſe extremities firſt open into a hollow veſicle, from whence the depoſited juice of ſeveral branches flows out through one common orifice.

in ſome meaſure defends the inner ſurface of the inteſtines, from the irritation to which it would, perhaps, otherwiſe be continually expoſed from the aliment, and which, when in a certain degree, excites a painful diſorder called *colic*, a name given to the diſeaſe, becauſe its moſt uſual ſeat is in the inteſtinum colon.

The inteſtines are likewiſe frequently diſtended with air, and this diſtenſion ſometimes occaſions pain, and conſtitutes the flatulent colic.

The arteries of the inteſtines are continuations of the meſenteric arteries, which are derived in two conſiderable branches from the aorta.—The redundant blood is carried back into the vena portarum.

In the rectum the veins are called hæmorrhoidal, and are there diſtinguiſhed into internal and external: the firſt are branches of the inferior meſenteric vein, but the latter paſs into other veins. Sometimes theſe veins are diſtended with blood from obſtructions, from weakneſs of their coats, or from other cauſes, and what we call the hæmorrhoids takes place.

In this diſeaſe they are ſometimes ruptured, and the diſcharge of blood which conſequently follows, has probably occaſioned them to be called *hæmorrhoidal* veins.

The nerves of the inteſtines are derived from the eighth pair.

## SECTION VI.

### *Of the Meſentery.*

THE name of the meſentery implies its ſituation amidſt the inteſtines. It is in fact a part of the peritonæum, being a reduplication (*c*) of that membrane from each ſide

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(*c*) He who only reads of the reduplication of membranes, will perhaps not eaſily underſtand how the peritonæum and pleura are reflected over the viſcera in their ſeveral cavities; for one of theſe ſerves the ſame purpoſes in the thorax, that the other does in the abdomen.—This diſpoſition, for the diſcovery of which we are indebted to modern anatomiſts, conſtitutes a curious part of anatomical knowledge: but the ſtudent, unaided by experience, and aſſiſted only by what the limits of this work would permit us to ſay on the occaſion, would probably imbibe only confuſed ideas of the matter; and it will perfectly anſwer the preſent purpoſe, if he conſiders the meſentery as a membrane attached by one of its ſides to the lumbar vertebræ, and by the other to the inteſtines.

of the lumbar vertebræ to which it is firmly attached, ſo that it is formed of two laminæ, connected to each other by cellular membrane.

The inteſtines in their different circumvolutions form a great number of arches, and the meſentery accompanies them through all theſe turns; but by being attached only to the hollow part of each arch, it is found to have only a third of the extent of the inteſtines.

That part of this membrane which accompanies the ſmall inteſtines is the *meſentery, properly ſo called*; but thoſe parts of it which are attached to the *colon* and *rectum* are diſtinguiſhed by the names of *meſo-colon* and *meſo-rectum*.

There are many conglobate glands diſperſed through this double membrane, through which the lacteals and lymphatics paſs in their way to the thoracic duct.—The blood-veſſels of the meſentery were deſcribed in ſpeaking of the inteſtines.

This membrane, by its attachment to the vertebræ, ſerves to keep the inteſtines in their natural ſituation.—The idea uſually formed of the colic called *miſerere*, is perfectly erroneous; it being impoſſible that the inteſtines can be twiſted, as many ſuppoſe they are, in that diſeaſe, their attachment to the meſentery effectually preventing ſuch an accident—but a diſarrangement ſometimes takes place in the inteſtinal canal itſelf, which is productive of diſagreeable and ſometimes fatal conſequences.—This is by an introſuſpection of the inteſtine, an idea of which may be eaſily formed, by taking the finger of a glove, and involving one part of it within the other.

If inflammation takes place, the ſtricture in this caſe is increaſed, and the periſtaltic motion of the inteſtines (by which is meant the progreſſive motion of the fæces downwards) is inverted, and what is called the iliac paſſion takes place. The ſame effects may be occaſioned by a deſcent of the inteſtine, or of the omentum either with it or by itſelf, and thus conſtituting what is called *an hernia* or *rupture*, a term by which in general is meant the falling down or protruſion of any part of the inteſtine, or omentum, which ought naturally to be contained within the cavity of the belly.

To convey an idea of the manner in which ſuch a deſcent takes place, it will be neceſſary to obſerve, that the lower edge of the tendon of the *muſculus obliquus externus*, is ſtretched from the fore-part of the os ilium or haunch-bone of the os pubis, and conſtitutes what is called *Poupart's*, or *Fallopius's ligament*, forming an opening, through which paſs the great crural artery and vein.—Near the os pubis the ſame tendinous fibres are ſeparated from each other, and form an opening on each ſide, called the *abdominal ring*, through which the ſpermatic veſſels paſs in men, and the ligamenta uteri in women.—In conſequence of violent efforts, or perhaps of natural cauſes, the inteſtines are found ſometimes to paſs through theſe openings; but the peritonæum which incloſes them when in their natural cavity, ſtill continues to ſurround them even in their deſcent. This membrane does not become torn or lacerated by the violence, as might be eaſily imagined; but its dilatability enables it to paſs out with the viſcus, which it incloſes as it were in a bag, and thus forms what is called the *hernial ſac*.

If the hernia be under Poupart's ligament, it is called *femoral*; if in the groin *inguinal*; (*d*) and *ſcrotal* if in the ſcrotum.—Different names are likewiſe given to the hernia as the contents of the *ſac* differ, whether of omentum only or inteſtine, or both—but theſe definitions more properly belong to the province of ſurgery.

## SECTION VII.

### *Of the Pancreas.*

THE pancreas is a conglomerate gland, placed behind the bottom of the ſtomach, towards the firſt vertebra of the loins; ſhaped like a dog's tongue, with its point ſtretched out towards the ſpleen, and its other end extending towards the duodenum. It is about eight fingers breadth in length, two or three in width, and one in thickneſs.

This viſcus, which is of a yellowiſh colour, ſomewhat inclined to red, is covered with a

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(*d*) The *hernia congenita* will be conſidered with the male organs of generation, with which it is intimately connected.

membrane which it derives from the peritonæum. Its arteries, which are rather numerous than large, are derived chiefly from the *ſplenic* and *hepatic*, and its veins paſs into the veins of the ſame name.—Its nerves are derived from the intercoſtal.

THE many little glands of which it has been obſerved the pancreas is compoſed, all ſerve to ſecrete a liquor called the pancreatic juice, which in its colour, conſiſtence, and other properties, does not ſeem to differ from the ſaliva. Each of theſe glands ſends out a little excretory duct, which uniting with others, help to form larger ducts, and all theſe at laſt, terminate in one common excretory duct, (firſt diſcovered by Virtſungus in 1642,) which runs through the middle of the gland, and is now uſually called *ductus pancreaticus Virtſungi.* This canal opens into the inteſtinum duodenum, ſometimes by the ſame orifice with the biliary duct, and ſometimes by a diſtinct opening—the liquor it diſcharges being of a mild and inſipid nature, ſerves to dilute the alimentary pulp, and to incorporate it more eaſily with the bile.

## SECTION VIII.

### *Of the Liver.*

THE liver is a viſcus of conſiderable ſize, and of a reddiſh colour; convex ſuperiorly and anteriorly where it is placed under the ribs and diaphragm, and of an unequal ſurface poſteriorly. It is chiefly ſituated in the right hypochondrium, and under the falſe ribs; but it likewiſe extends into the epigaſtric region, where it borders upon the ſtomach. It is covered by a production of the peritonæum, which ſerves to attach it by three of its reduplications to the falſe ribs.—Theſe reduplications are called *ligaments*, though very different in their texture from what are called by the ſame name in other parts of the body. The umbilical cord too, which in the fœtus is pervious, gradually becomes a ſimple ligament after birth, and by paſſing to the liver, ſerves likewiſe to ſecure it in its ſituation.

AT the poſterior part of this organ where the umbilical veſſels enter, it is found divided into two lobes—of theſe the largeſt is placed in the right hypocondrium; the other, which covers part of the ſtomach, is called the little lobe. All the veſſels which go to the liver paſs in at the fiſſure we have mentioned, and the production of the peritonæum, which inveſts the liver, accompanies them in their paſſage, and ſurrounds them like a glove.—The credit of this diſcovery is due to an Engliſh anatomiſt, in honour of whom this membranous production is now univerſally known by the name of *Gliſſon*'s *capſula*.

The liver was conſidered by the ancients, as an organ deſtined to prepare and perfect the blood; but later diſcoveries have proved that this opinion was wrong, and that the liver is a glandular ſubſtance formed for the ſecretion of the bile.

The blood is conveyed to the liver by the hepatic artery and the vena portæ. This is contrary to the mode of circulation in other parts, where veins only ſerve to carry off the redundant blood; but in this viſcus the hepatic artery, which is derived from the cæliac, is wholly deſtined for its nouriſhment; and the vena

portæ,

porta, which is formed by the union of the veins from all the principal abdominal viſcera, only furniſhes the blood from which the bile is to be ſeparated: ſo that theſe two ſeries of veſſels ſerve very diſtinct purpoſes. The vena portæ, as it is ramified through the liver, performs the office both of an artery and a vein; for it not only carries blood to the liver, but after having depoſited the bile, brings back not only its own redundant blood, but likewiſe that of the hepatic artery into the vena cava.

THE nerves of the liver are branches of the intercoſtal and par vagum.—The bile, after being ſeparated from the maſs of blood, in a manner of which mention will be made in another place, is conveyed out of this organ by very minute excretory ducts, called *pori biliarii*; theſe uniting together like the excretory ducts in the pancreas, gradually form larger ones, which at length terminate in a conſiderable channel called *ductus hepaticus.*

## SECTION IX.

### *Of the Gall-bladder.*

THE gall-badder is a little membranous bag, ſhaped like a pear, and attached to the poſterior and almoſt inferior part of the great lobe of the liver.

It has two tunics; of which the exterior one is a production of the peritonæum.—The interior, or villous coat, is ſupplied with a mucus that defends it from the acrimony of the bile. Theſe two coverings are intimately connected by means of cellular membrane, which from its firm, gliſtening appearance, has generally been ſpoken of as a muſcular tunic.

The gall-bladder is ſupplied with blood-veſſels from the hepatic arteries; theſe branches are called the *cyſtic arteries*, and the *cyſtic veins* carry back the blood.

Its nerves are derived from the ſame origin as thoſe of the liver.

The neck of the gall-bladder is continued in the form of a canal called *ductus cyſticus*, which ſoon unites with the *ductus hepaticus* we deſcribed as the excretory duct of the liver, and forming one common canal, takes the name of *ductus choledochus communis*, through which both the cyſtic and hepatic bile are diſcharged into the duodenum; this canal opens into the inteſtine in an oblique direction, firſt paſſing through the exterior tunic, and then piercing the other coats after running between each of them a very little way.—This œconomy ſerves two uſeful purpoſes—to promote the diſcharge of bile and to prevent its return.

## *Of the Bile.*

The bile may be defined to be a natural liquid ſoap ſomewhat unctuous and bitter, and of a yellowiſh colour, which eaſily mixes with water, oil, and vinous ſpirits, and is capable of diſſolving reſinous ſubſtances. From ſome late experiments made by M. Cadet *, it appears to be formed of an animal oil, combined with the alkaline baſe of ſea-ſalt, a ſalt of the nature of milk, and a calcareous earth which is ſlightly ferruginous.

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* Mem. de l'Acad. des Sciences, 1767.

Its definition ſeems ſufficiently to point out the uſes for which it is intended (*e*).—It blends the alimentary maſs, by dividing and attenuating it; corrects the too great diſpoſition to aceſcency, which the aliment acquires in the ſtomach; and finally by its acrimony, tends to excite the periſtaltic motion of the inteſtines.

After what has been ſaid, it will be conceived that there are two ſorts of bile, one of which is derived immediately from the liver through the hepatic duct, and the other from the gall-bladder—theſe two biles, however, do not eſſentially differ from each other. The hepatic bile indeed is milder, and more liquid than the cyſtic, which is conſtantly thicker and yellower, and by being bitterer, ſeems to poſſeſs greater activity than the other.

Every body knows the ſource of the *hepatic bile*, that it is ſecreted from the maſs of blood

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(*e*) The ancients, who were not acquainted with the real uſe of the liver, conſidered the bile as an excrementitious and uſeleſs fluid.

blood by the liver: but the origin of the *cyſtic bile*, has occaſioned no little controverſy amongſt anatomical writers. There are ſome who contend, that it is ſeparated in the ſubſtance of the liver, from whence it paſſes into the gall-bladder through particular veſſels. In deer, and in ſome other quadrupeds, as well as in ſeveral birds and fiſhes, there is an evident communication by means of particular veſſels, between the liver and the gall-bladder.—Bianchi, Winſlow, and others, have aſſerted the exiſtence of ſuch veſſels in the human ſubject, and named them *hepaticyſtic ducts*, but it is certain that no ſuch ducts exiſt.—In obſtructions of the cyſtic duct, the gall-bladder has been found ſhrivelled and empty; ſo that we may conſider the gall-bladder, as a reſervoir of hepatic bile; the difference in the colour, conſiſtence, and taſte of the bile, being merely the conſequence of ſtagnation and abſorption.—When the ſtomach is diſtended with aliment, this reſervoir undergoes a certain degree of compreſſion, and the bile paſſes out into the inteſtinal canal; and in the efforts to vomit, the gall-bladder ſeems to be conſtantly affected, and at ſuch times diſcharges itſelf of its contents.

Sometimes the bile concretes in the gall-bladder, ſo as to form what are called *gall-ſtones* (*g*); and when theſe concretions paſs into the cyſtic duct, they ſometimes occaſion exquiſite pain, by diſtending the canal in their way to the duodenum; and by lodging in the ductus choledochus communis, and obſtructing the courſe of the bile, this fluid will be abſorbed, and by being carried back into the circulation, occaſion a temporary jaundice.

## SECTION X.

### *Of the Spleen.*

THE ſpleen is a ſoft and ſpongy viſcus, of a bluiſh colour, and about five or ſix fingers breadth in length, and three in width, ſituated-

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(*g*) Theſe concretions ſometimes remain in the gall-bladder without cauſing any uneaſineſs. Dr. Heberden relates, that a gall-ſtone weighing two drachms was found in the gall-bladder of the late Lord Bath, though he had never complained of the jaundice, nor of any diſorder which he could attribute to that cauſe.—*Med. Tranſ.* Vol. II.

ed in the left hypochondrium, between the ſtomach and the falſe ribs. That ſide of it which is placed on the ſide of the ribs is convex, and the other, which is turned towards the ſtomach is concave.

The ſplenic artery, which is a branch from the cæliac, ſupplies this viſcus with blood, and a vein of the ſame name carries it back into the venæ porta.

Its nerves are derived from a particular plexus called the ſplenic, which is formed by branches of the intercoſtal nerve, and by the eighth pair, or par vagum.

The ancients, who ſuppoſed two ſorts of bile, conſidered it as the receptacle of what they called *atra bilis*. Havers, who wrote profeſſedly on the bones, determined its uſe to be that of ſecreting the ſynovia; and the late Mr. Hewſon imagined, that it concurred with the thymus and lymphatic glands of the body, in forming the red globules of the blood; all theſe opinions ſeem to be equally fanciful. The want of an excretory duct has occaſioned the real uſe of this viſcus to be ſtill doubtful. Perhaps the blood undergoes ſome change in it, which may aſſiſt in the preparation of the bile. —This is the opinion of the generality of modern phyſiologiſts; and the great quantity of blood with which it is ſupplied, together with the courſe of its veins into the vena portæ, ſeem to render this notion probable.

## SECTION XI.

### *Of the Glandulæ Renales, Kidneys, and Ureters.*

THE *glandulæ renales*, which were by the ancients ſuppoſed to ſecrete the *atra bilis*, and by them named *capſulæ atrabilares*, are two flat bodies of an irregular figure, one on each ſide between the kidney and the aorta.

In the fœtus they are as large as the kidneys, but they do not increaſe afterwards in proportion to thoſe parts; and in adults and old people they are generally found ſhrivelled, and much waſted.—They have their arteries and veins. Their arteries uſually ariſe from the ſplenic or the emulgent, and ſometimes from the aorta; and their veins go to the neighbouring veins, or to the vena cava: their nerves are branches of the intercoſtal.

The uſe of theſe parts is not yet perfectly known.—In the fœtus the ſecretion of urine muſt be in a very ſmall quantity, and a part of the blood may perhaps then paſs through theſe channels, which in the adult is carried to the kidneys, to ſupply the matter of urine.

The *kidneys* are two in number, ſituated one on the right and the other on the left-ſide in the lumbar region, between the laſt falſe rib and the os ilium, by the ſides of the vertebræ—each kidney in its figure reſembles a ſort of bean, which from its ſhape is called *kidney-bean.*—The concave part of each kidney is turned towards the aorta and vena cava aſcendens. They are ſurrounded by a good deal of fat, and receive a coat from the peritonæum; and when this is removed, a very fine membrane is found inveſting their ſubſtance and the veſſels which ramify through them.

Each kidney has a conſiderable artery and vein, which are called the *emulgent*. The artery is a branch from the aorta, and the vein paſſes into the vena cava. Their nerves, which every where accompany the blood-veſſels, ariſe from a conſiderable *plexus*, which is derived from the intercoſtal.

In each kidney, which in the adult is of a pretty firm texture, there are three ſubſtances to be diſtinguiſhed (*k*). The outer part is *glandular* or *cortical*—beyond this is the *vaſcular* or *tubular ſubſtance*; and the inner part is *papillary* or *membranous*.

It is in the cortical part of the kidney, that the ſecretion is carried on; the urine being here received from the minute extremities of the capillary arteries, is conveyed out of this cortical ſubſtance by an infinite number of very ſmall cylindrical canals or excretory veſſels, which conſtitute the *tubular* part. Theſe tubes as they approach the inner ſubſtance of the kidney, gradually unite together; and thus

(*k*) The kidneys in the fœtus are diſtinctly lobulated, but in the adult they become perfectly firm, ſmooth, and regular.

ſorming larger canals, at length terminate in ten or twelve little protuberances called *papillæ*, the orifices of which may be ſeen without the aſſiſtance of glaſſes. Theſe papillæ open into a ſmall cavity or reſervoir called the *pelvis* of the kidney, and formed by a diſtinct membranous bag which embraces the papillæ. From this pelvis the urine is conveyed through a membranous canal which paſſes out from the hollow ſide of the kidney, a little below the blood-veſſels, and is called *ureter*.

THE *ureters* are each about as large as a common writing-pen. They are ſomewhat curved in their courſe from the kidneys, like the letter *ſ*, and at length terminate in the poſterior, and almoſt inferior part of the bladder, at ſome diſtance from each other. They paſs into the bladder in the ſame manner as the *ductus choledochus communis* paſſes into the *inteſtinum duodenum*; not by a direct paſſage, but by an oblique courſe between the two coats; ſo that the diſcharge of urine into the bladder is promoted, whilſt its return is prevented.—Nor does this mode of ſtructure prevent the paſſage of fluids only from the bladder into the ureters, but likewiſe air:—for air thrown into the bladder inflates it, and it continues to be diſtended if a ligature is paſſed round its neck; which ſeems to prove ſufficiently, that it cannot paſs into the ureters.

## SECTION XII.

### *Of the Urinary Bladder.*

THE *urinary bladder* is a membranous and muſcular bag of an oblong roundiſh ſhape, ſituated in the pelvis, between the os pubis and inteſtinum rectum in men, and between the os pubis and vagina in women. Its upper and wideſt part is uſually called the *bottom*, its narrower part the *neck* of the bladder; the former only is covered by the peritonæum.

The bladder is formed of two coats, connected together by means of cellular membrane. The external, or *muſcular* coat, is compoſed of irritable, and of courſe muſcular fibres, which are moſt collected around the neck of the bladder, but not ſo as to form a diſtinct muſcle, or *ſphincter*, as the generality of anatomiſts have hitherto ſuppoſed.

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The inner or *villous* coat reſembles the villous tunic of the inteſtines, and like that is provided with a mucus, which defends it againſt the acrimony of the urine.

## *Of the Urine.*

It will be eaſily conceived from what has been ſaid, that the kidneys are two glandular bodies, through which a ſaline and excrementitious fluid called *urine*, is conſtantly filtring from the maſs of blood.

While only a ſmall quantity of urine is collected in the bladder, it excites no kind of uneaſineſs; but when a greater quantity is accumulated, ſo that the bladder is diſtended in a certain degree, it excites in us a certain ſenſation, which brings on as it were a voluntary contraction of the bladder to promote its diſcharge:—but this contraction is not effected by the muſcular fibres of the bladder alone, for all the abdominal muſcles contract in obedience to our will, and preſs downwards all the viſcera of the lower belly; and theſe powers being united, at length overcome the reſiſtance of the fibres ſurrounding the neck of the bladder, which dilates and affords a paſſage to the urine through the urethra.

The frequency of this evacuation depends on the quantity of urine ſecreted; on the degree of acrimony it poſſeſſes; on the ſize of the bladder, and on its degree of ſenſibility.

The urine varies much in its colour and contents. Theſe varieties depend on age, ſex, climate, diet, and other circumſtances. In infants it is generally a clear watery fluid, without ſmell or taſte. As we advance in life, it acquires more colour and ſmell, and becomes more impregnated with ſalts. In old people it becomes ſtill more acrid and fœtid.

In a healthy ſtate it is nearly of a ſtraw colour.—After being kept for ſome time, it depoſits a tartarous matter, which is found to be compoſed chiefly of earth and ſalt, and ſoon incruſts the ſides of the veſſel in which it is contained. While this ſeparation is taking place, appearances like minute fibres or threads of a whitiſh colour, may be ſeen in the middle of the urine, and an oily ſcum obſerved floating on its ſurface. So that the moſt common appearances of the urine are ſufficient to aſcertain that it is a watery ſubſtance, impregnated with earthy, ſaline, and oily particles.

THE urine is not always voided of the ſame colour and conſiſtence; for theſe are found to depend on the proportion of its watery part, to that of its other conſtituent principles.—Its colour and degree of fluidity ſeem to depend on the quantity of ſaline and inflammable particles contained in it; ſo that an increaſed proportion of thoſe parts will conſtantly give the urine a higher colour, and add to the quantity of ſediment.

THE variety in the appearance of the urine, depends on the nature and quantity of ſolid and fluid aliment we take in; and it is likewiſe occaſioned by the different ſtate of the urinary veſſels, by which we mean the channels through which it is ſeparated from the blood, and conveyed through the pelvis into the ureters. The cauſes of calculous concretions in the urinary paſſages, are to be looked for in the natural conſtitution of the body, mode of life, &c.

It having been obſerved, that after drinking any light wine or ſpa water, it very ſoon paſſed off by urine, it has been ſuppoſed by ſome, that the urine is not altogether conveyed to the bladder by the ordinary courſe of circulation, but that there muſt certainly exiſt ſome other ſhorter means of communication, perhaps by certain veſſels between the ſtomach and the bladder; or by a retrograde motion in the lymphatics; but it is certain, that if we open the belly of a dog, preſs out the urine from the bladder, paſs a ligature round the emulgent arteries, and then ſew up the abdomen, and give him even the moſt diuretic liquor to drink, the ſtomach and other channels will be diſtended with it, but not a drop of urine will be found to have paſſed into the bladder. This experiment then ſeems to be a ſufficient proof, that all the urine we evacuate, is conveyed to the kidneys through the emulgent arteries, in the manner we have deſcribed. —It is true, that wine and other liquors promote a ſpeedy evacuation of urine, but the diſcharge ſeems to be merely the effect of the ſtimulus they occaſion; by which the bladder and urinary parts are ſolicited to a more copious diſcharge of the urine, which was before in the body, and not immediately of that which was laſt drank; and this increaſed diſcharge, if the ſupply is kept up, will continue: nor will this appear wonderful, if we conſider the great capacity of the veſſels that go to the kidneys; the conſtant ſupply of freſh blood that is eſſential to health; and the rapidity with which it is inceſſantly circulated through the heart to all parts of the body.

## SECTION XIII.

### *Of Digeſtion.*

WE are now proceeding to ſpeak of *digeſtion*, which ſeems to be introduced in this place with propriety, after a deſcription of the abdominal viſcera, the greater part of which contribute to this function.—By *digeſtion* is to be underſtood, the changes the aliment undergoes for the formation of chyle—theſe changes are effected in the mouth, ſtomach, and ſmall inteſtines.

The *mouth*, of which every body has a general knowledge, is the cavity between the two jaws, formed anteriorly and laterally by the lips, teeth, and cheeks, and terminating poſteriorly in the throat.

The lips and cheeks are made up of fat and muſcles, covered by the cuticle, which is continued over the whole inner ſurface of the mouth, like a fine and delicate membrane—beſide this membrane, the inſide of the mouth is furniſhed with a ſpongy and very vaſcular ſubſtance called the gums, by means of which the teeth are ſecured in their ſockets—a ſimilar ſubſtance covers the roof of the mouth, and forms what is called the *velum pendulum palati*, which is fixed to the extremity of the arch formed by the oſſa maxillaria and oſſa palati, and terminates in a ſoft, ſmall, and conical body, named *uvula*; which appears, as it were ſuſpended from the middle of the arch over the baſis of the tongue.

The velum pendulum palati performs the office of a valve between the cavity of the mouth

mouth and the pharynx, being moved by ſeveral muſcles (*a*).

THE *tongue* is compoſed of ſeveral muſcles (*b*) which enable it to perform a variety of motions for the articulation of the voice; for the purpoſes of maſtication; and for conveying the aliment into the pharynx.—Its upper part is covered with *papillæ*, which conſtitute the organ of taſte, and are eaſily to be diſtinguiſhed; it is covered by the ſame membrane that lines the inſide of the mouth, and which makes at its inferior part towards its baſis, a reduplication called *frænum*.

POSTERIORLY under the velum palati, and at the baſis of the tongue is the *pharynx*, which is the beginning of the œſophagus, ſtretched out every way, ſo as to reſemble the top of a funnel, through which the aliment paſſes into the ſtomach.

THE *mouth* has a communication with the noſtrils at its poſterior and upper part; with the

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(*a*) Theſe are the *circumflexus palati*, *levator palati mollis*, *palato-pharyngæus*, *conſtrictor iſthmi faucium*, and *azygos uvulæ*. See page 147, & *ſeq*.

(*b*) Theſe are, the *genio-gloſſus*, *cerato-gloſſus*, *lingualis*, and *ſtylo-gloſſus*. See page 146, & *ſeq*.

the ears by the Euſtachian tubes; with the lungs by means of the larynx; and with the ſtomach by means of the œſophagus.

The *pharynx* is conſtantly moiſtened by a fluid, ſecreted by two conſiderable glands called the *tonſils*, one on each ſide of the velum palati. Theſe glands, from their ſuppoſed reſemblance to almonds, have likewiſe been called *amygdales*.

The mouth is moiſtened by a conſiderable quantity of ſaliva. This fluid is derived from the *parotid glands*, a name which by its etymology points out their ſituation to be near the ears. They are two in number, one on each ſide under the os malæ, and are of the conglomerate kind; being formed of many ſmaller glands, each of which ſends out a very ſmall excretory duct, which unites with the reſt, to form one common channel, that runs over the cheek, and piercing the buccinator muſcle, opens into the mouth on each ſide, by an orifice into which a briſtle may be eaſily introduced—beſides theſe, the *maxillary glands*, which are placed near the inner ſurface of the angle of the lower jaw on each ſide.—The *ſub-*

*lingual glands*, which are ſituated at the root of the tongue, and the *glands of the palate*, which are ſeated in the velum palati, together with many other leſs conſiderable ones, pour the ſaliva into the mouth through their ſeveral excretory ducts.

The *ſaliva*, like all the other humours of the body, is found to be different in different people; but in general, it is a limpid and inſipid fluid, without ſmell in healthy ſubjects; and theſe properties would ſeem to prove, that it contains very few ſaline or inflammable particles.

The uſes of the ſaliva ſeem to be to moiſten and lubricate the mouth, and to aſſiſt in reducing the aliment into a ſoft pulp before it is conveyed into the ſtomach.

## *Of Hunger and Thirſt.*

The variety of functions which are conſtantly performed by the living body, muſt neceſſarily occaſion a continual waſte and diſſipation of its ſeveral parts.—A great quantity is every day thrown off by the inſenſible perſpiration and other diſcharges; and were not theſe loſſes conſtantly recruited by a freſh ſupply of chyle, the body would ſoon effect its own diſſolution. But nature has very wiſely favoured us with organs fitted to produce ſuch a ſupply, and has at the ſame time endued us with the ſenſations of *hunger* and *thirſt*, that our attention may not be diverted from the neceſſary buſineſs of nutrition. The ſenſation of hunger is univerſally known; but it would perhaps be difficult to deſcribe it perfectly in words.—It may however be defined to be a certain uneaſy ſenſation in the ſtomach, which induces us to wiſh for ſolid food; and which likewiſe ſerves to point out the proper quantity, and time for taking it.—In deſcribing the ſtomach, mention was made of the *gaſtric juice*, as every where lubricating its inner coat. This humour mixes itſelf with the aliment in the ſtomach, and helps to prepare it for its paſſage into the inteſtines; but when the ſtomach is perfectly empty, this ſame fluid irritates the coats of the ſtomach itſelf, and produces the ſenſation of *hunger*.

A CERTAIN proportion of liquid aliment is required to aſſiſt in the proceſs of digeſtion, and to afford that moiſture to the body, of which there is ſuch a conſtant diſſipation.—*Thirſt* induces us to take this neceſſary ſupply of drink; and the ſeat of this ſenſation is in the tongue, fauces and œſophagus, which from their great ſenſibility are required to be kept moiſt: for though the fauces are naturally moiſtened by the mucus and ſalival juices, yet the blood when deprived of its watery part or rendered acrimonious by any natural cauſes, never fails particularly to affect theſe parts, and the whole alimentary canal, and to occaſion *thirſt*.—This is the common effect of fevers and of hard labour, by both which too much of the watery part of the blood is diſſipated.

## *Of Maſtication and Deglutition.*

It has been obſerved, that the aliment undergoes ſome preparation in the mouth before it paſſes into the ſtomach; and this preparation is the effect of *maſtication*.—In treating of the upper and lower jaws, mention was made of the number and arrangement of the teeth. The upper jaw was deſcribed as being immoveable; but the lower jaw was ſpoken of as being capable of elevation and depreſſion, and of a grinding motion. The aliment when firſt carried into the mouth, is preſſed between the teeth of the two jaws by a very ſtrong and frequent motion of the lower jaw; and the tongue and the cheeks aſſiſting in this proceſs, continue to replace the food between the teeth till it is perfectly divided, and reduced to the conſiſtence of pulp.—The inciſores and canini divide it firſt into ſmaller pieces, but it is between the ſurfaces of the dentes molares by the grinding motion of the jaw that the maſtication is completed.

During this proceſs, the ſalival glands being gently compreſſed by the contraction of the muſcles that move the lower jaw, pour out their ſaliva, which helps to divide and break down the food, which at length becomes a kind of pulp, and is then carried over the baſis of the tongue into the fauces. But to effect this paſſage into the œſophagus, it is neceſſary that the other openings which were mentioned as having a communication with the mouth as well as the pharynx, ſhould be cloſed; that none of the aliment, whether ſolid or liquid, may paſs into them, whilſt the pharynx alone is dilated to receive it—ſuch a diſpoſition actually takes place in a manner we will endeavour to deſcribe.

The *trachea arterea* or *windpipe*, through which the air is conveyed to the lungs, is placed before the œſophagus—in the act of ſwallowing; therefore, if the *larynx* (for ſo the upper part of the trachea is called) is not cloſed, the aliment will paſs into it in its way to the œſophagus. But this is prevented by a ſmall and very elaſtic cartilage, called *epiglottis*, which is attached only to the fore-part of the larynx, ſo that the food in its paſſage to the œſophagus, preſſes down this cartilage which then covers the *glottis* or opening of the larynx; and at the ſame time the *velum palati* being capable of ſome degree of motion, is drawn backwards by its muſcles, and cloſes the openings into the noſe and the Euſtachian tubes—this, however, is not all.—The larynx, which being compoſed of cartilaginous rings, cannot fail in its ordinary ſtate to compreſs the membranous canal of the œſophagus, is in the act of *deglutition*, carried forwards and upwards by muſcles deſtined for that purpoſe; and conſequently drawing the fore-part of the pharynx with it, that opening is fully dilated. When the aliment has reached the pharynx, its deſcent is promoted by its own proper weight, and by the muſcular fibres of the œſophagus, which continue to contract from above downwards, until the aliment has reached the ſtomach. That theſe fibres have no inconſiderable ſhare in deglutition, any perſon may experience, by ſwallowing with his head downwards, when the deſcent of the aliment cannot poſſibly be effected by its weight.

It is neceſſary that the noſtrils and the lungs ſhould communicate with the mouth, for the purpoſes of ſpeech and reſpiration: but if the moſt minute part of our food happens to be introduced into the trachea, it never fails to produce a violent cough, and ſometimes the moſt alarming ſymptoms—this is liable to happen when we laugh or ſpeak in the act of deglutition—the food is then ſaid to have paſſed the wrong way; and indeed this is not improperly expreſſed, for death would ſoon follow, if the quantity of aliment introduced into the trachea ſhould be ſufficient to obſtruct the reſpiration only during a very ſhort time; or if the irritating particles of food ſhould not ſoon be thrown up again by means of the cough, which in theſe caſes very ſeaſonably increaſes in proportion to the degree of irritation.

If the velum palati did not cloſe the paſſage to the noſtrils, deglutition would be performed with difficulty, and perhaps not at all, for the aliment would return through the noſe, as is ſometimes the caſe in drinking.—Children, from a deficiency in this velum palati, have been ſeen to die a few hours after birth; and they who from diſeaſe or any other cauſes have not this part perfect, ſwallow with difficulty.

The aliment, after having been ſufficiently divided by the action of the teeth, and attenuated by the ſaliva, is received into the ſtomach, where it is deſtined to undergo a more conſiderable change.

The properties of the aliment not being much altered at its firſt entrance into the ſtomach, and before it is thoroughly blended with the gaſtric juice, is capable of irritating the inner coat of the ſtomach to a certain degree, and occaſions a contraction of its two orifices. —In this membranous bag, ſurrounded by the abdominal viſcera, and with a certain degree of natural heat, the aliment undergoes a conſtant agitation by means of the abdominal muſcles and of the diaphragm; and likewiſe by a certain contraction or expanſion of the muſcular fibres of the ſtomach itſelf. By this motion, every part of the food is expoſed to the action of the gaſtric juice, which gradually divides and attenuates it, and prepares it for its paſſage into the inteſtines. Some obſervations lately publiſhed by Mr. Hunter in the Philoſophical Tranſactions, tend to throw conſiderable light on the principles of digeſtion. There are few dead bodies in which the ſtomach, at its great end, is not found to be in ſome degree digeſted. Animals, or parts of animals, poſſeſſed of the living principle, when taken into the ſtomach, are not in the leaſt affected by the action of that viſcus; but the moment they loſe the living principle, they become ſubject to its digeſtive powers. This ſeems to be the caſe with the ſtomach, which is enabled to reſiſt the action of its juices in the living body, but when deprived of the living principle, is then no longer able to reſiſt the power of that menſtruum, which it had itſelf formed for the digeſtion of its contents: the proceſs of digeſtion appearing to be continued after death. This is confirmed by what happens in the ſtomachs of fiſhes: they frequently ſwallow without maſtication, fiſh which are larger than the digeſting parts of their ſtomach can contain, and in ſuch caſes, that part which is taken into the ſtomach, is more or leſs diſſolved, while that part which remains in the œſophagus is perfectly ſound; and here, as well as in the human body, the digeſting part of the ſtomach is often reduced to the ſame ſtate as the digeſted part of the food.—Theſe appearances lead to prove, that digeſtion is not effected by a mechanical power, by contractions of the ſtomach, or by heat; but by a fluid ſecreted in the coats of the ſtomach, which is poured into its cavity, and there animalizes the food, or aſſimilates it to the nature of blood.

The food, after having remained during one, two, or three hours in the ſtomach, is converted into a greyiſh pulp, which is uſually called *chymus*, a word of Greek etymology, ſignifying *juice*, and ſome few milky or chylous particles begin to appear.—But the term of its reſidence in this bag is proportioned to the nature of the aliment, and to the ſtate of the ſtomach and its juices. The thinner and more perfectly digeſted parts of the food paſs by a little at a time into the duodenum, thro' the pylorus, the fibres of which relax to afford it a paſſage; and the groſſer and leſs digeſted particles, remain in the ſtomach till they acquire a ſufficient fluidity to paſs into the inteſtines, where the nature of the *chymus* is perfectly changed. The bile and pancreatic juice which flow into the duodenum, and the mucus, which is every where diſtilled from the ſurface of the inteſtines, mix themſelves with the alimentary pulp, which they ſtill farther attenuate and diſſolve, and into which they ſeem to infuſe new properties.

Two matters very different from each other in their nature and deſtination, are the reſult of this combination.—One of theſe, which is compoſed of the liquid parts of the aliment, and of ſome of its more ſolid particles, extremely divided and mixed with the juices we have deſcribed, conſtitutes a very mild, ſweet, and whitiſh fluid, reſembling milk, and diſtinguiſhed by the name of *chyle*. This fluid is abſorbed by the lacteal veins, which convey it into the circulation, where, by being aſſimilated into the nature of blood, it affords that ſupply of nutrition, which the continual waſte of the body is found to require.—The other, is the remains of the alimentary maſs deprived of all its nutritious particles, and containing only ſuch parts as were rejected by the abſorbing mouths of the lacteals. This groſſer part, called the *fæces*, paſſes on through the courſe of the inteſtines, to be voided at the anus, as will be explained hereafter; for this proceſs in the œconomy cannot be well underſtood, till the motion of reſpiration has been explained. But the ſtructure of the inteſtines is a ſubject which may be properly deſcribed in this place, and deſerves to be attended to.

It has been already obſerved, that the inteſtinal canal is five or ſix times as long as the body, and that it forms many circumvolutions in the cavity of the abdomen, which it traverſes from the right to the left, and again from the left to the right; in one place deſcending, and in another extending itſelf upwards. It was noticed likewiſe, that the inner coat of the inteſtines, by being more capacious than their exterior tunics, formed a multitude of plaits placed at a certain diſtance from each other, and called *valvulæ conniventes.*—Now this diſpoſition will be found to afford a farther proof of that divine wiſdom, which the anatomiſt and phyſiologiſt cannot fail to diſcover in all their purſuits;—for if the inteſtinal canal was much ſhorter than it naturally is; if inſtead of the preſent circumvolutions it paſſed in a direct courſe from the ſtomach; and if its inner ſurface was ſmooth and deſtitute of valves; the aliment would conſequently paſs with great rapidity to the anus, and ſufficient time would be wanting to aſſimilate the chyle, and for the neceſſary abſorption of it into the lacteals: ſo that the body would be deprived of the ſupply of nutrition, which is ſo eſſential to life and health—but the length and circumvolutions of the inteſtines, the inequality of their internal ſurface, and the courſe of the aliment through them, all concur to perfect the ſeparation of the chyle from the fæces, and to afford the neceſſary nouriſhment to the body.

## SECTION XIV.

### *Of the Courſe of the Chyle, and of the Lymphatic Syſtem.*

AN infinite number of very minute veſſels called the *lacteal veins*, ariſe like network from the inner ſurface of the inteſtines, (but principally from the *jejunum* and *ileum*,) which are deſtined to imbibe the nutritious fluid or chyle. Theſe veſſels which were diſcovered by Aſellius in 1622 (*o*), paſs obliquely, through

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(*o*) We are informed by Galen, that the lacteals had been ſeen by Eraſiſtratus in kids, who conſidered them as arteries carrying a milky fluid—but from the remote time in which he lived, they do not ſeem to have been noticed till they were diſcovered in a living dog by Aſellius, who denominated them *lacteals*, and conſidered them as ſerving to convey the chyle from the inteſtines to the liver; for before the diſcovery of the thoracic duct, the uſe of the liver was univerſally ſuppoſed to be that of converting the chyle into blood.—But the diſcovery of the thoracic duct by Pecquet, not long after, corrected this error.—Pecquet very candidly confeſſes, that his diſcovery accidentally aroſe from his obſerving a white fluid, mixed with the blood, flowing out of the vena cava, after he had cut off the heart of a living dog, which he ſuſpected to through the coats of the inteſtine, and running along the meſentery unite as they advance, and form larger branches, all of which paſs through the meſenteric or conglobate glands, which are very numerous in the human ſubject. As they run between the inteſtines and theſe glands, they are ſtiled *venæ lacteæ primi generis*; but after leaving theſe glands they are found to be leſs numerous, and being increaſed in ſize, are then called *venæ lacteæ ſecundi generis*, which go to depoſit their contents in the *thoracic duct*, through which the chyle is conveyed into the blood.

THIS *thoracic duct* begins about the lower part of the firſt vertebra lumborum, from whence it paſſes up by the ſide of the aorta, between that and the vena azygos, cloſe to the vertebræ, being covered by the pleura. Sometimes it is found divided into two branches, but they uſually unite again into one canal, which opens into the left ſubclavian vein, af-

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to be chyle, and afterwards traced to its ſource from the thoracic duct:—This duct had been ſeen near an hundred years before in a horſe by Euſtachius, who ſpeaks of it as a vein of a particular ſtructure, but, without knowing any thing of its termination or uſe.

ter having run a little way in an oblique courſe between its coats. The ſubclavian vein communicates with the vena cava, which paſſes to the right auricle of the heart.

The lower part of this duct being uſually larger than any other part of it, has been named *receptaculum chyli*, or *Pecquet*'s *receptacle*, in honour of the anatomiſt who firſt diſcovered it in 1651. In ſome quadrupeds, in turtle and in fiſh, this enlargement (*p*) is more conſiderable in proportion to the ſize of the duct, than it uſually is in the human ſubject, where it is not commonly found large enough to merit the name of *receptaculum*.

Opportunities of obſerving the lacteals in the human ſubject do not often occur; but they may eaſily be demonſtrated in a dog or any other quadruped that is killed two or three hours after feeding upon milk, for then they appear filled with white chyle.

But theſe *lacteals* which we have deſcribed, as paſſing from the inteſtines through the meſentery to the thoracic duct, compoſe only a

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(*p*) Hewſon's Exp. Inq. Part. II.

part of a ſyſtem of veſſels which perform the office of *abſorption*, and which conſtitute with their common trunk the thoracic duct, and the conglobate glands that are diſperſed through the body, what may be ſtiled the *lymphatic ſyſtem*. So that what is ſaid of the ſtructure of one of theſe ſeries of veſſels, may very properly be applied to that of the other.

THE *lymphatic veins* (*q*) are minute pellucid tubes, which, like the lacteals, direct their courſe towards the centre of the body, where

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(*q*) The arteries in their courſe through the body becoming gradually too minute to admit the red globules of the blood, have then been ſtiled *capillary* or *lymphatic arteries*. The veſſels which are here deſcribed as conſtituting the lymphatic ſyſtem, were at firſt ſuppoſed to be continued from thoſe arteries, and to convey back the lymph, either into the red veins or the thoracic duct; the office of abſorption having been attributed to the *red veins*. But we know that the *lymphatic veins* are not continuations of the *lymphatic arteries*, but that they conſtitute the *abſorbent ſyſtem*. There are ſtill, however, ſome very reſpectable names among the anatomiſts of the preſent age, who contend, that the red veins act likewiſe as abſorbents:—but it ſeems to have been clearly proved, that the red veins do abſorb no where but in the cavernous cells of the penis, the erection of which is occaſioned by a diſtenſion of thoſe cells with arterial blood.

they pour a colourleſs fluid into the thoracic duct. The lymphatics from all the lower parts of the body, gradually unite as they approach this duct, into which they enter by three or four very large trunks, that ſeem to form the lower extremity of this canal, or *receptaculum chyli*, which may be conſidered as the great trunk of the lymphatic ſyſtem. The lacteals open into it near the ſame place, and the lymphatics from all the upper parts of the body, pour their lymph into different parts of this duct as it runs upwards, to terminate in the left ſubclavian vein.

As the lymphatics commonly lie cloſe to the large blood-veſſels, a ligature paſſed round the crural artery in a living animal, by including the lymphatics, will occaſion a diſtenſion of theſe veſſels below the ligature, ſo as to demonſtrate them with eaſe; and a ligature paſſed round the thoracic duct, inſtantly after killing an animal, will, by ſtopping the courſe of its contents into the ſubclavian vein, diſtend not only the lacteals, but alſo the lymphatics in the abdomen and lower extremities, with their natural fluids (*r*).

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(*r*) In the dead body they may be eaſily demonſtrated by opening the artery ramifying through any viſcus, as in

The coats of theſe veſſels are too thin to be ſeparated from each other; but the mercury they are capable of ſuſtaining, proves them to be very ſtrong; and their great power of contraction, after undergoing conſiderable diſtenſion, together with the irritability with which Baron Haller found them to be endued (*s*), ſeems to render it probable, that like the blood-veſſels, they have a muſcular coat.

The lymphatics are nouriſhed after the ſame manner as all the other parts of the body. For even the moſt minute of theſe veſſels, are probably ſupplied with ſtill more minute arteries and veins. This ſeems to be proved by the inflammation of which they are ſuſceptible; and the painful ſwellings which ſometimes take place in lymphatic veſſels, prove that they have nerves as well as blood-veſſels.

Both the lacteals, lymphatics, and thoracic duct, are furniſhed with valves, which are

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in the ſpleen, for inſtance, and then throwing in air; by which the lymphatics will be diſtended. One of them may then be punctured, and mercury introduced into it through a blow pipe.

(*s*) Sur le mouvement du Sang. Exp. 295, 298.

much more common in theſe veſſels than in the red veins. Theſe valves are uſually in pairs, and ſerve to promote the courſe of the chyle and lymph towards the thoracic duct, and to prevent its return.—Mention has been made of the glands, through which the lacteals paſs in their courſe through the meſentery; and it is to be obſerved, that the lymphatics paſs through ſimilar glands in their way to the thoracic duct.—Theſe glands are all of the conglobate kind, but the changes, which the chyle and lymph undergo in their paſſage through them, have not yet been aſcertained.

The *lymphatic veſſels* begin from ſurfaces and cavities in all parts of the body as *abſorbents*.—This is a fact now univerſally allowed; but how the fluids they abſorb are poured into thoſe cavities, is a ſubject of controverſy.—The contents of the abdomen, for inſtance, were deſcribed as being conſtantly moiſtened by a very thin watery fluid.—The ſame thing takes place in the pericardium, pleura, and all the other cavities of the body, and this watery fluid is the *lymph*. But whether it is exhaled into thoſe cavities through the minute ends of arteries, or tranſuded through their coats, are the points in diſpute. We cannot here be permitted to relate the many ingenious arguments that have been advanced in favour of each of theſe opinions; nor is it perhaps of conſequence to our preſent purpoſe, to enter into the diſpute.—It will be ſufficient if the reader can form an idea of what the lymph is, and of the manner in which it is abſorbed.

THE *lymph*, from its tranſparency and want of colour, would ſeem to be nothing but water; and hence the firſt diſcoverers of theſe veſſels ſtiled them *ductus aquoſi*—but experiments prove, that the lymph of an healthy animal coagulates by being expoſed to the air, or a certain degree of heat, and likewiſe by being ſuffered to reſt; ſeeming to agree in this property, with that part of the blood called the *coagulable lymph*.—This property of the lymph leads to determine its uſe, in moiſtening and lubricating the ſeveral cavities of the body, in which it is found; and for which, by its gelatinous principle, it ſeems to be much better calculated than a pure and watery fluid would be, for ſuch it has been ſuppoſed to be by ſome anatomiſts.

THE mouths of the *lymphatics* and *lacteals*, by acting as capillary tubes, ſeem to abſorb the *lymph* and *chyle* in the ſame manner as a capillary tube of glaſs, when put into a baſon of water, is enabled to attract the water into it to a certain height.—In the human body the *lymph*, or the *chyle*, is probably conveyed upon this principle, as far as the firſt pair of valves, which ſeem to be placed not far from the orifice of the abſorbing veſſel, whether *lymphatic* or *lacteal:* and the fluid will then be propelled forwards, by a continuation of the abſorption at the orifice. But this does not ſeem to be the only inducement to its progreſs towards the thoracic duct—theſe veſſels have probably a muſular coat, which may ſerve to preſs the fluid forwards from one pair of valves to another; and as the large lymphatic veſſels and the thoracic duct are placed cloſe to the large arteries, which have a conſiderable pulſation; it is reaſonable to ſuppoſe, that they derive ſome advantages from this ſituation.

# SECTION XV.

## *Of the Male Organs of Generation.*

THE *male organs of generation* have been uſually divided into the parts which ſerve to prepare the ſemen from the blood, and thoſe which are deſtined to convey it into the womb. But it ſeems to be more proper to diſtinguiſh them into the *preparing*, the *containing*, and the *expelling* parts, which are the different offices of the *teſtes*, the *veſiculæ ſeminales*, and the *penis*; and this is the order in which we propoſe to deſcribe them.

The teſtes are two glandular bodies, ſerving to ſecrete the ſemen from the blood. They are originally formed and lodged within the cavity of the abdomen, and it is not till after the child is born, or very near that time, that they begin to paſs into the groin, and from thence into the ſcrotum (*u*).—By this diſpoſition

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(*u*) It ſometimes happens in diſſecting ruptures, that the inteſtine is found in the ſame ſac, and in contact with the teſtis. This appearance was at firſt attributed to tion they are very wiſely protected from the injuries to which they would be liable to be expoſed, from the different poſitions of the child at the time of parturition.

The teſticles in this ſtate are looſely attached to the *pſoæ muſcles*, by means of the peritonæum by which they are covered: and they are at this time of life connected in a very particular manner to the parietes of the abdomen, and likewiſe to the ſcrotum, by means of a ſubſtance, which Mr. Hunter calls the *ligament* or *gubernaculum teſtis*, becauſe it

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to a ſuppoſed laceration of the peritonæum; but later obſervations, by pointing out the ſituation of the teſticles in the fœtus, have led to prove, that the teſtis as it deſcends into the ſcrotum, carries with it a portion or elongation of the peritonæum, which becomes its *tunica vaginalis* or a kind of ſac, in which the teſticle is lodged, as will be explained in the courſe of this ſection. The communication between this ſac and the cavity of the abdomen, is uſually ſoon cut off; but in ſome ſubjects it continues open during life; and when an *hernia* or deſcent of the ieteſtine takes place in ſuch a ſubject, it does not puſh down a portion of the peritonæum before it, as it muſt otherwiſe neceſſarily do, but paſſes at once through this opening, and comes in contact with the naked teſticle, conſtituting that particular ſpecies of rupture, called *hernia congenita*.

connects the teſtis with the ſcrotum, and directs its courſe in its deſcent.—This *gubernaculum* is of a pyramidal form, with its bulbous head fixed to the lower end of the *teſtis* and *epididymis*, and loſes its lower and ſlender extremity in the cellular membrane of the ſcrotum. It is difficult to aſcertain, what the ſtructure and compoſition of this gubernaculum is; but it is certainly vaſcular and fibrous; and from certain circumſtances it would ſeem, to be in part compoſed of the cremaſter muſcle, running upwards to join the lower end of the teſtis.

We are not to ſuppoſe that the teſticle, when deſcended into the ſcrotum, is to be ſeen looſe as a piece of gut or omentum would be in a common hernial ſac.—We have already obſerved, that during its reſidence in the cavity of the abdomen, it is attached to the peritonæum, which deſcends with it; ſo that when the ſac is completed in the ſcrotum, the teſticle is at firſt attached only to the *poſterior* part of it, while the *fore*-part of it lies looſe, and for ſome time affords a communication with the abdomen.—The *ſpermatic chord*, which is made up of the *ſpermatic artery* and *vein*, and of the *vas deferens* or *excretory duct of the teſtis*, is cloſely attached behind to the poſterior part of this elongation of the peritonæum.—But the *fore*-part of the peritonæal ſac, which is at firſt looſe, and not attached to the teſticle, cloſes after a certain time, and becomes united to the *poſterior* part, and thus perfectly ſurrounds the teſticle as it were in a purſe.

The teſticles of the fœtus differ only in their ſize and ſituation from thoſe of the adult—in their paſſage from the abdomen they deſcend through the abdominal rings into the ſcrotum, where they are ſupported and defended by various integuments.

What the immediate cauſe of this deſcent is, has not yet been ſatisfactorily determined. It has been aſcribed to the effects of reſpiration, but the teſticles have ſometimes been found in the ſcrotum before the child has breathed; and it does not ſeem to be occaſioned by the action of the cremaſter muſcle, becauſe the ſame effect would be liable to happen in the hedgehog, and ſome other quadrupeds, whoſe teſticles remain in the abdomen during life.

The *ſcrotum*, which is the external or common covering of both teſticles, is a kind of ſac formed by the common integuments, and externally divided into two equal parts by a prominent line called *raphe*.

In the inner part of the ſcrotum we meet with a cellular coat called *dartos* (*y*), which by its duplicature, divides the ſcrotum into two equal parts, and forms what is called *ſeptum ſcroti*, which correſponds with the raphe. —The collapſion which is ſo often obſerved to take place in the ſcrotum of the healthy ſubject, when excited by cold, or by the ſtimulus of venery, ſeems to be very properly attributed to the contractile motion of the ſkin, and not to any muſcular fibres, as is the caſe in dogs and ſome other quadrupeds.

The ſcrotum then, by means of its ſeptum, is found to make two diſtinct bags, in which

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((*y*) The dartos has uſually been conſidered as a muſcle, and is deſcribed as ſuch both by Douglas and Winſlow.—But there being no part of the ſcrotum of the human ſubject, which can be ſaid to conſiſt of muſcular fibres, Albinus and Haller have very properly omitted to deſcribe the dartos as a muſcle, and conſider it merely as a cellular coat.

the teſticles inveſted by their proper tunics, are ſecurely lodged and ſeparated from each other.—Theſe coats are the *cremaſter*, the *tunica vaginalis*, and the *tunica albuginea*.—The firſt of theſe is compoſed of muſcular fibres, and is to be conſidered only as a partial covering of the teſtis, for it ſurrounds only the ſpermatic chord, and terminates upon the upper and external parts of the tunica vaginalis teſtis, ſerving to draw up and ſuſpend the teſticle (*a*). The *tunica vaginalis teſtis* has already been deſcribed as being a thin production of the peritonæum, looſely adhering every where to the teſticle, which it includes as it were in a bag.—The *tunica albuginea* is a firm, white, and very compact membrane of a gliſtening appearance, which immediately inveſts the body of the teſtis and the epididymis; ſerving in ſome meaſure to connect them to each other, but without extending itſelf at all to the ſpermatic chord. This tunica albuginea ſerves to con-

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(*a*) The *cremaſter* muſcle is compoſed of a few fibres from the obliquus internus abdominis, which uniting with a few from the tranſverſalis, deſcend upon the ſpermatic chord, and are inſenſibly loſt upon the tunica vaginalis of the teſticle. It ſerves to ſuſpend and draw up the teſticle.

fine the growth of the teſtis and epididymis within certain limits, and by giving them a due degree of firmneſs, enables them to perform their proper functions.

HAVING removed this laſt tunic, we diſcover the ſubſtance of the teſticle itſelf, which appears to be made up of an infinite number of very elaſtic filaments, which may be beſt diſtinguiſhed after macerating the teſticle in water.—Each teſticle is made up of the ſpermatic artery and vein, and the exrcetory veſſels or tubuli ſeminiferi. There are likewiſe a great number of abſorbent veſſels, and ſome branches of nerves to be met with in the teſticles.

THE *ſpermatic arteries* ariſe one on each ſide from the aorta, generally about an inch below the emulgents. The *right ſpermatic vein* commonly paſſes into the *vena cava*; but the *left ſpermatic vein*, uſually empties itſelf into the *emulgent* on that ſide; and it is ſuppoſed to take this courſe into the emulgent, that it may avoid paſſing over the aorta, which it would be obliged to do in its way to the vena cava.

The blood is circulated very ſlowly through the ſpermatic artery, which makes an infinite number of circumvolutions in the ſubſtance of the teſticle, where it depoſits the ſemen, which paſſes through the *tubuli ſeminiferi.*—Theſe *tubuli ſeminiferi*, are ſeen running in ſhort waves from the tunica albuginea to the axis of the teſticle; and are divided into diſtinct portions by certain thin membranous productions, which originate from the tunica albuginea. They at length unite, and by an infinite number of convolutions form a ſort of appendix to the teſtis, called *epididymis* (*a*), which is a vaſcular body of an oblong ſhape, ſituate upon the ſuperior part of each teſticle. Theſe tubuli of the epididymis at length form an excretory duct called *vas deferens*, which aſcends towards the abdominal rings, with the other parts that make up the ſpermatic chord, and then a ſeparation takes place; the nerves and blood-veſſels paſſing on to their ſeveral terminations, and the *vas deferens* going to depoſit its ſemen in the *veſiculæ ſeminales*, which are two ſoft bodies of a white and convoluted appearance ex-

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(*a*) The teſticles were named *didymi* by the ancients, and the name of this part was given to it on account of its ſituation upon the teſticle.

ternally, ſituated obliquely between the rectum and the lower part of the bladder, and uniting together at the lower extremity: From theſe reſervoirs, which are plentifully ſupplied with blood-veſſels and nerves, the ſemen is occaſionally diſcharged through two ſhort paſſages, which open into the urethra cloſe to a little eminence called *verumontanum*.

NEAR this eminence we meet with the *proſtate*, which is ſituated at the neck of the bladder, and is deſcribed as being of a glandular ſtructure.—It is ſhaped ſomewhat like a heart with its ſmall end foremoſt, and inveſts the origin of the *urethra*. Internally it appears to be of a firm ſubſtance, and compoſed of ſeveral follicles, ſecreting a whitiſh viſcid fluid, that is diſcharged by ten or twelve excretory ducts into the urethra, on each ſide of the openings of the veſiculæ ſeminales at the ſame time, and from the ſame cauſes that the ſemen is expelled. As this latter fluid is found to be exceedingly limpid in the veſiculæ ſeminales of the dead ſubject, it probably owes its whiteneſs and viſcidity to this liquor of the proſtate.

The *penis*, which is to be conſidered as the vehicle or active organ of procreation, is compoſed of two columns, the *corpora cavernoſa* and *corpus ſpongioſum.*—The *corpora cavernoſa*, which conſtitute the greateſt part of the penis, may be deſcribed as two cylindrical, ligamentous tubes, each of which is compoſed of an infinite number of minute cells of a ſpongy texture, which communicate with each other. —Theſe two bodies are of a very pliant texture, and capable of conſiderable diſtenſion; and being united laterally to each other, occaſion by this union, a ſpace above and another below.—The uppermoſt of theſe ſpaces is filled by the blood-veſſels, and the lower one, which is larger than the other by the urethra. Theſe two cavernous bodies are at firſt only ſeparated by a partition of tendinous fibres, which allow them to communicate with each other; but they afterwards divaricate from each other like the branches of the letter Y, and diminiſhing gradually in ſize, are attached, one on each ſide, by means of the *ligamentum ſuſpenſorium penis* to the *ramus iſchii*, and to the inferior portion of the os pubis.

THE *corpus ſpongioſum penis*, or *corpus ſpongioſum urethræ*, as it is ſtiled by ſome authors, begins as ſoon as the urethra has paſſed the *proſtate*, with a thick origin almoſt like a heart, firſt under the urethra, and afterwards above it, becoming gradually thinner, and ſurrounding the whole canal of the urethra, till it terminates in a conſiderable expanſion, and conſtitutes what is called the *glans penis*, which is exceedingly vaſcular, and covered with papillæ like the tongue.—The cuticle which lines the inner ſurface of the urethra, is continued over the *glans* in the ſame manner as it is ſpread over the lips.

THE penis is inveſted by the common integuments, but the cutis is reflected back every where from the glans as it is in the eye-lids, ſo that it covers this part when the penis is in a relaxed ſtate, as it were with a hood, and from this uſe is called *prepuce*.

THE *prepuce* is tied down to the under part of the *glans*, by a ſmall ligament called *frœnum*, which is in fact only a continuation of the cuticle and cutis.—There are many ſimple ſebaceous follicles called *glandulæ odoriferæ*, placed round the baſis of the *glans*, and the fluid they ſecrete, ſerves to preſerve the exquiſite ſenſibility of this part of the penis, and to prevent the ill effects of attrition from the prepuce.

The *urethra* may be defined to be a membranous canal, paſſing from the bladder through the whole extent of the penis. Several very ſmall openings called *lacunæ*, communicate with this canal, through which a mucus is diſcharged into it; and beſides theſe, there are two glands, firſt deſcribed by Cowper, as ſecreting a fluid for lubricating the urethra, and called *Cowper*'s *glands* (*c*); and Littre (*d*) ſpeaks of a gland ſituated near the proſtate, as being deſtined for the ſame uſe.

The urethra being continued from the neck of the bladder, is to be conſidered as making part of the urinary paſſage; and it likewiſe affords a conveyance to the ſemen, which we have

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(*c*) Both Heiſter and Morgagni obſerve, that they have ſometimes not been able to find theſe glands, ſo that they do not ſeem to exiſt in all ſubjects.

(*d*) Memoires de l'Acadamie Royale des Sciences, 1700.

have obſerved, is occaſionally diſcharged into it from the veſiculæ ſeminales. The direction of this canal being firſt under and then before the pubis, occaſion a winding in its courſe from the bladder to the penis, not unlike the turns of the letter *S*.

THE penis has three pair of muſcles, the *erectores*, *acceleratores*, and *tranſverſales*. The firſt originate from the tuberoſity of the iſchium, and terminate in the corpora cavernoſa. The *acceleratores* ariſe from the ſphincter, and by their inſertion ſerve to compreſs the bulbous part of the urethra; and the *tranſverſales* are deſtined to afford a paſſage to the ſemen, by dilating the canal of the urethra.

THE arteries of the penis are chiefly derived from the internal iliacs. Some of them are ſuppoſed to terminate by pabulous orifices within the corpora cavernoſa and corpus ſpongioſum; and others terminate in veins, which at laſt make up the *vena magna dorſi penis*, and other ſmaller veins, which are in general diſtributed in like order with the arteries.

Its nerves are large and numerous; they ariſe from the great ſciatic nerve, and accompany the arteries in their courſe through the penis.

We have now deſcribed the anatomy of this organ, and there only remains to be explained, how it is enabled to attain that degree of firmneſs and diſtenſion, which is eſſential to the great work of generation.

The greateſt part of the penis has been ſpoken of, as being of a ſpongy and cellular texture, plentifully ſupplied with blood-veſſels and nerves, and as having muſcles to move it in different directions: now, the blood is conſtantly paſſing into its cells through the ſmall branches of the arteries which open into them, and is from thence as conſtantly abſorbed by the pabulous orifices of ſome of its veins, ſo long as the corpora cavernoſa and corpus ſpongioſum continue to be in a relaxed and pliant ſtate. But when from any nervous influence or other means, which it is not neceſſary here to define or explain, the erectores or other muſcles of the penis, are induced to contract; the veins undergo a certain degree of compreſſion, and the paſſage of the blood through them is ſo much impeded, that it collects in them in a greater proportion than they are enabled to carry off: ſo that the penis gradually enlarges, and being more and more forcibly drawn up againſt the os pubis, the vena magna itſelf is at length compreſſed, and the penis becomes fully diſtended. But as the cauſes which firſt occaſioned this diſtenſion ſubſide, the penis gradually returns to its ſtate of relaxation.

## *Of the Female Organs of Generation.*

ANATOMICAL writers uſually divide the female organs of generation into *external* and *internal*. In the firſt diviſion they include the *mons veneris*, *labia pudendi*, *perinæum*, *clitoris*, *nymphæ* and *carunculæ myrtiformes*; and in the latter, the *vagina*, with the *uterus* and its appendages.

THE *mons veneris*, which is placed on the upper part of the ſymphiſis pubis, is internally compoſed of adipoſe membrane, which makes it ſoft and prominent: it divides into two parts called *labia pudendi*, which deſcending towards the rectum, from which they are divided by the perinæum, form what is called the *fourchette.* The perinæum is that fleſhy ſpace which extends about an inch and an half from the *fourchette* to the anus, and from thence about two inches to the cocyx.

The labia pudendi being ſeparated, we obſerve a ſulcus called *foſſa magna*; in the upper part of which is placed the clitoris, a ſmall round ſpongy body, in ſome meaſure reſembling the male penis, but impervious, compoſed of two *corpora cavernoſa*, ariſing from the tuberoſities of the os iſchii; furniſhed with two pair of muſcles, the *erectores clitoridis*, and the *conſtrictores cunni*; and terminating in a *glans*, which is covered with its prepuce. From the lower part, on each ſide of the foſſa, paſs the *nymphæ*, two membranous and ſpongy folds which ſeem deſtined for uſeful purpoſes in parturition, by tending to enlarge the volume of the vagina, as the child's head paſſes through it.—Between theſe, about the middle of the foſſa magna, we perceive the orifice of the *vagina* or *os externum*, cloſed by folds and wrinkles; and about half an inch above this, and about an inch below the clitoris, appears the *meatus urinarius* or orifice of the *urethra*, much ſhorter, though ſomewhat larger than in men, with a little prominence at its lower edge, which facilitates the introduction of the catheter.

THE os externum is ſurrounded on the inſide by ſeveral membranous folds called *carunculæ myrtiformes*, which are commonly ſuppoſed to be the remains of a thin membrane called *hymen*, that covers the vagina in children. In general, the hymen is ſufficiently open to admit the paſſage of the menſes, if it exiſts at the time of their appearance; ſometimes, however, it has been found perfectly cloſed.

THE *vagina*, ſituated between the urethra and the rectum, is compoſed of two membranes, one of which is muſcular, and the other a continuation of that which covers the foſſa magna, ſurrounded with a ſpongy cellular ſubſtance. It terminates in the uterus about half an inch above the os tincæ, and is wider and ſhorter in women who have had children than in virgins.

All theſe parts are plentifully ſupplied with blood-veſſels and nerves. Around the nymphæ there are ſebaceous follicles, which pour out a fluid to lubricate the inner ſurface of the vagina; and the meatus urinarius, like the urethra in the male ſubject, is conſtantly moiſtened by a mucus, which defends it againſt the acrimony of the urine.

The *uterus* is a hollow viſcus, ſituated in the hypogaſtric region, between the rectum and bladder. It is deſtined to receive the firſt rudiments of the fœtus, and to aſſiſt in the developement of all its parts, till it arrives at a ſtate of perfection, and is fitted to enter into the world, at the time appointed by the wiſe Author of nature.

The uterus in its unimpregnated ſtate, reſembles a pear in ſhape, ſomewhat flattened, with its *fundus* or bottom part turned towards the abdomen, and its *cervix* or *neck* ſurrounded by the vagina.—The entrance into its cavity forms a little protuberance, which has been compared to the mouth of a tench, and is therefore called *os tincæ*.

The ſubſtance of the uterus, which is of a conſiderable thickneſs, appears to be compoſed of many glands interwoven with ſmall ligamentous fibres, ſmall branches of nerves, ſome lymphatics, and with arteries and veins innumerable. Its nerves are chiefly derived from the intercoſtal, and its arteries and veins from the hypogaſtric and hemorrhoidal. The membrane which lines its cervix, is a continuation of the inner membrane of the vagina; but the outer ſurface of the body of the uterus is covered with the peritonæum, which is reflected over it, and deſcends from thence to the inteſtinum rectum. This duplicature of the peritonæum, by paſſing off from the ſides of the uterus to the ſides of the pelvis, is there firmly connected, and forms what are called *ligamenta uteri lata*; which not only ſerve to ſupport the uterus, but to convey nerves and blood-veſſels to it.

The *ligamenti uteri rotunda* ariſe from the ſides of the fundus uteri, and paſſing along within the fore-part of the ligamenta lata, deſcend through the abdominal rings, and terminate in the ſubſtance of the mons veneris. The ſubſtance of theſe ligaments is vaſcular, and although both they and the ligamenta lata admit the uterus in the virgin ſtate, to move only about an inch up and down; yet in the courſe of pregnancy they admit of conſiderable diſtenſion, and after parturition, return nearly to their original ſtate with ſurprizing quickneſs.

On each ſide of the inner ſurface of the uterus, in the angle near the fundus, a ſmall orifice is to be diſcovered, which is the beginning of one of the *tubæ fallopianæ*—each of theſe tubes, which are two in number, paſſing through the ſubſtance of the uterus, is extended along the broad ligaments, till it reaches the edge of the pelvis, from whence it reflects back, and turning over behind the ligaments, about an inch of its extremity is ſeen hanging looſe in the pelvis, near the ovarium.—Theſe extremities having a jagged appearance, are called *fimbriæ*, or *morſus diaboli*. Each tubia fallopiana is uſually about three inches long. Their cavities are at firſt very ſmall, but becomes gradually larger, like a trumpet, as they approach the fimbriæ.

NEAR the fimbriæ of each tuba fallopiana, about an inch from the uterus, is ſituated an oval body called *ovarium*, of about half the ſize of the male teſticle.—Each of theſe *ovaria* is covered by a production of the peritonæum, and hangs looſe in the pelvis.—They are of a flat and angular form, and appear to be compoſed of a white and glandular ſubſtance, in which we are able to diſcover ſeveral minute veſicles filled with a coagulable lymph, of an uncertain number, but not often exceeding twelve in each ovary.—In the female of riper years, theſe veſicles become exceedingly turgid, and a kind of yellow coagulum is gradually formed within one of them, which increaſes till its coat diſappears, and it then changes into an hemiſpherical body, called *corpus luteum*, which reſembles a bunch of currants, and is hollow, containing within its cavity the very minute membranes or eggs, each of which may become the ſeat of a fœtus.—In conception, one of theſe mature ova is ſuppoſed to be impregnated with the male ſemen, and to be ſqueezed out of its nidus into the fallopian tube; and it is obſervable, that the number of ſcars or fiſſures in the ovarium, conſtantly corre-

ſponds

ſponds with the number of fœtuſes excluded by the mother.

## *Of Conception.*

MAN, being ever curious and inquiſitive, has naturally been led to inquire after the origin of his exiſtence; and the ſubject of generation has employed the philoſophical world in all ages: but in following nature up to her minute receſſes, the philoſopher ſoon finds himſelf bewildered, and his imagination often ſupplies that which he ſo eagerly wiſhes to diſcover, but which is deſtined perhaps never to be revealed to him. Of the many theories which have been formed on this ſubject, that of the ancient philoſophers ſeems to have been the moſt ſimple; they conſidered the male ſemen as alone capable of forming the fœtus, and believed that the female only afforded it a lodging in the womb, and ſupplied it with nouriſhment after it was perfectly formed.—This opinion, however, ſoon gave place to another, in which the female was allowed a more conſiderable ſhare in conception.

THIS ſecond ſyſtem conſidered the fœtus as being formed by the mixture of the ſeminal liquor of both ſexes, by a certain arrangement of its ſeveral particles in the uterus.—But in the 16th century, veſicles or eggs were diſcovered in the ovaria or female teſticles; the fœtus had been found ſometimes in the abdomen, and ſometimes in the fallopian tubes; and the two former opinions were exploded in favour of a new doctrine. The ovaria were compared to a bunch of grapes, being ſuppoſed to conſiſt of veſicles, each of which had a ſtalk, ſo that it might be diſengaged without hurting the reſt, or ſpilling the liquor it contained. Each veſicle was ſaid to include a little animal, almoſt complete in all its parts; and the vapour of the male ſemen being conveyed to the ovarium, was ſuppoſed to produce a fermentation in the veſicle, which approached the neareſt to maturity; and thus inducing it to diſengage itſelf from the ovarium, it paſſed into the tuba fallopiana, through which it was conveyed into the uterus. Here it was ſuppoſed to take root like a vegetable ſeed, and to form, with the veſſels originating from the uterus, what is called the *placenta*; by means of which the circulation is carried on between the mother and the fœtus.

THIS opinion, with all its abſurdities, continued to be almoſt univerſally adopted, till the cloſe of the ſame century, when Leeuwenhoeck, by means of his glaſſes, diſcovered certain opake particles, which he deſcribed as ſo many *animalcula*, floating in the ſeminal fluid of the male.

THIS diſcovery introduced a new ſchiſm among the philoſophers of that time, and gave riſe to a ſyſtem which is not yet entirely exploded. According to this theory, the male ſemen paſſing into the tubæ fallopianæ, one of the animalcula penetrates into the ſubſtance of the ovarium, and enters into one of its veſicles or ova. This impregnated ovum is then ſqueezed from its huſk, through the coats of the ovarium, and being ſeized by the fimbriæ, is conducted through the tube to the uterus, where it is nouriſhed till it arrives at a ſtate of perfection. In this ſyſtem there is much ingenuity, but there are certain circumſtances ſuppoſed to take place, which have been hitherto inexplicable. A celebrated modern writer, M. Buffon, endeavours to reſtore, in ſome meaſure, the moſt ancient opinion, by allowing the female ſemen a ſhare in this office; aſſerting, that animalcula or organic particles are to be diſcovered in the ſeminal liquor of both ſexes: he derives the female ſemen from the ovaria, and he contends that no *ovum* exiſts in thoſe parts.—But in this idea he is evidently miſtaken; and the opinion now moſt generally adopted is, that an impregnation of the ovum, by the influence of the male ſemen, is eſſential to conception.—That the ovum is to be impregnated, there can be no doubt; but as the manner in which ſuch an impregnation is ſuppoſed to take place, and the means by which the ovum afterwards gets into the fallopian tube, and from thence into the uterus, are ſtill founded chiefly on hypotheſis, we will not attempt to extend farther, the inveſtigation of a ſubject, concerning which ſo little can be advanced with certainty.

## *Of the Fœtus in Utero.*

OPPORTUNITIES of diſſecting the human gravid uterus occurring but ſeldom, the ſtate of the *embryo* (*f*) immediately after conception cannot be perfectly known.

When the ovum deſcends into the uterus, it is ſuppoſed to be very minute; and it is not till ſeveral days after conception, that the rudiments of the embryo begin to be aſcertained. —About the ſeventh day the eye may diſcover the firſt lineaments of the fœtus; but theſe lineaments are as yet very imperfect. Two little veſicles appear in an almoſt tranſparent jelly, the largeſt of which is deſtined to become the head of the fœtus, and the other ſmaller one is reſerved for the trunk. But at this period no extremities are to be ſeen; the umbilical chord appears only as a very minute thread, and the placenta does not as yet abſorb the red particles of the blood. At the end of fifteen days, not only the head but the features of the face begin to be developed.—The noſe appears like a ſmall prominent line, and we are able to diſcover another line under it, which is deſtined for the ſeparation of

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(*f*) The rudiments of the child are uſually diſtinguiſhed by this name, till the human figure can be diſtinctly aſcertained, and then it has the appellation of *fœtus.*

the lips. Two black points appear in the place of eyes, and two minute holes mark the ears—at the ſides of the trunk, both above and below, we ſee four minute protuberances, which are the rudiments of the arms and legs. At the end of three weeks the body of the fœtus is ſomewhat augmented, and both the hands and feet are to be diſtinguiſhed. The upper extremities are found to increaſe faſter than the lower ones, and the ſeparation of the fingers is accompliſhed ſooner than that of the toes.

Towards the end of the firſt month, the fœtus is about an inch long, and the human form may be deciſively aſcertained—all the parts of the face may be diſtinguiſhed, the ſhape of the body is clearly marked out, the haunches and the abdomen are elevated, the fingers and toes are ſeparated from each other, and the inteſtines appear like minute threads. After ſix weeks the fœtus is grown much longer, and the human figure appears to be more perfect, but the head is ſtill larger in proportion than the other parts of the body.

At the end of the ſecond month, the fœtus meaſures two inches and a quarter, at the end of the third month three inches and a half, and about the fourth or fifth month, uſually about five inches; and from that time to the end of the ninth month it gradually increaſes to about the length of twelve inches, ſometimes more, and ſometimes not quite ſo much.

The fœtus during all this time aſſumes an oval figure, which correſponds with the ſhape of the uterus. Its chin is found reclining on its breaſt with its knees drawn up towards its chin, and its arms folded over them. But it ſeems likely, that the poſture of ſome of theſe parts is varied in the latter months of pregnancy, ſo as to cauſe thoſe painful twitches, which its mother uſually feels from time to time.—In natural caſes its head is probably placed towards the os tincæ, from the time of conception to that of its birth; though formerly it was conſidered as being placed towards the fundus uteri, till about the eighth or ninth month, when the head, by becoming ſpecifically heavier than the other parts of the body, was ſuppoſed to be turned downwards.

The capacity of the uterus increaſes in proportion to the growth of the fœtus, but without becoming thinner in its ſubſtance as might naturally be expected.—The nouriſhment of the fœtus, during all this time, ſeems to be derived from the placenta, which appears to be originally formed by that part of the ovum which is next the fundus uteri. The remaining unconnected part of the ovum, and likewiſe the ſurface of the placenta, are covered by a membrane called *chorion* (*g*); and within, this is another pellucid membrane called *amnios* (*h*); and theſe two include a watery fluid,

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(*g*) Beſides theſe two membranes, Dr. Hunter has diſcovered a third, which is the exterior one, being ſuppoſed to be a lamella from the inner ſurface of the uterus. In the latter months of pregnancy it becomes gradually thinner and more connected with the chorion—he has named it *membrana caduca,* or *decidua,* as it is caſt off with the placenta.

(*h*) In ſome quadrupeds the urine appears to be conveyed from the bladder through a canal called *urachus,* to the *allantois,* which is a reſervoir, reſembling a long and blind gut, ſituated between the chorion and amnios. The human fœtus ſeems to have no ſuch reſervoir, though ſome writers have ſuppoſed that it does exiſt. From the top of the bladder, a few longitudinal fibres are extended to the umbilical chord; and theſe fibres have been conſidered as the urachus, though without having been ever found pervious.

which is the *liquor amnii* (*i*), in which the fœtus floats till the time of its birth.—In the firſt months of pregnancy, the involucra bear a large proportion to their contents; but this proportion is afterwards reverſed, as the fœtus increaſes in bulk.

The placenta, which is the medium through which the blood is conveyed from the mother to the fœtus, and the manner in which this conveyance takes place, deſerve to be clearly deſcribed, as being a ſubject not generally underſtood.—Without ſuch an explanation it might perhaps be readily ſuppoſed, that the arteries of the uterus paſs into the ſubſtance of the placenta; and that the blood, after being conveyed through the umbilical arteries to the

(*i*) The liquor amnii coagulates like the lymph. It has been ſuppoſed to paſs into the œſophagus, and to afford nouriſhment to the fœtus; but this does not ſeem probable. Children have come into the world without an œſophagus, or any communication between the ſtomach and the mouth; but there has been no well atteſted inſtance, of a child's having been born without a placenta; and it does not ſeem likely, that any of the fluid can be abſorbed through the pores of the ſkin, the ſkin in the fœtus being every where covered with a great quantity of mucus.

fœtus, is returned back by the umbilical vein to the placenta, and from thence to the uterus. —Such an idea, however, would be a very erroneous one. We will point out the true manner in which this proceſs is conducted.

The *placenta* is a broad, flat, and ſpongy ſubſtance, like a cake, cloſely adhering to the inner ſurface of the womb, uſually near the fundus, and appearing as it were made up of the ramifications of the umbilical arteries and vein. The arteries of the uterus diſcharge their contents into the ſpongy cells of this cake, and the veins of the placenta, abſorbing the blood from theſe cells in the ſame manner as they abſorb it in the corpora cavernoſa penis, at length form the *umbilical vein*, which paſſes on to the ſinus of the vena portæ, and from thence to the vena cava, by means of the *canalis venoſus*, a communication that is cloſed in the adult. But the circulation of the blood through the heart is not conducted in the fœtus as in the adult: in the latter, the blood is carried from the right auricle of the heart through the pulmonary artery, and is returned to the left auricle by the pulmonary vein; but a dilatation of the lungs is eſſential to the paſſage of the blood through the pulmonary veſſels, and this dilatation cannot take place till after the child is born and has reſpired. This deficiency, however, is ſupplied in the fœtus by an immediate communication between the right and left auricle, through an oval opening, in the ſeptum which divides the two auricles, called *foramen ovale*. The blood is likewiſe tranſmitted from the pulmonary artery to the aorta, by means of a duct called *canalis arterioſus*, which, like the canalis venoſus, and foramen ovale, gradually cloſes after birth.

THE blood is returned again from the fœtus through two arteries called the *umbilical arteries*, which ſometimes ariſe from the iliacs, and ſometimes from the aorta deſcendens. Theſe two veſſels taking a winding courſe with the vein, form with that, and the membranes by which they are ſurrounded, what is called the *umbilical chord*. Theſe arteries, after ramifying through the ſubſtance of the placenta, open and diſcharge their blood into its cells, from whence it is abſorbed by the veins of the uterus; ſo that a conſtant depoſition and abſorption are carried on, and the fœtus is found to have a circulation independent of its mother.

## CHAP. V.

### *Of the Thorax.*

THE *thorax*, or cheſt, is that cavity of the trunk which extends from the clavicles or the lower part of the neck, to the diaphragm, and includes the vital organs, which are the heart and lungs; and likewiſe the trachea and œſophagus.—This cavity is formed by the ribs and vertebræ of the back, covered by a great number of muſcles, and by the common integuments, and anteriorly by two glandular bodies called the breaſts.—The ſpaces between the ribs are filled up by muſcular fibres, which from their ſituation, are called intercoſtal muſcles.

## SECTION I.

### *Of the Breaſts.*

THE *breaſts* may be defined to be two large conglomerate glands, mixed with a good deal of adipoſe membrane. The glandular part is compoſed of an infinite number of minute arteries, veins, and nerves.

THE arteries are derived from two different trunks, one of which is called the *internal*, and the other the *external mammary artery.* The firſt of theſe ariſes from the ſubclavian, and the latter from the axillary.

THE veins every where accompany the arteries, and are diſtinguiſhed by the ſame name. —The nerves are chiefly from the vertebral pairs.—Like all other conglomerate glands, the breaſts are made up of a great many ſmall diſtinct glands, in which the milk is ſecreted from the ultimate branches of arteries. The excretory ducts of theſe ſeveral glands, gradually uniting as they approach the nipple, form the *tubuli lactiferi* (*l*), which are uſually about ſeven or eight in number, and open at its apex. Theſe ducts, in their courſe from the glands, are ſurrounded by a ligamentary elaſtic ſubſtance, which terminates with them in the nipple. Both this ſubſtance, and the ducts which it contains, are capable of conſiderable extenſion and contraction; but in their natural ſtate are moderately corrugated, ſo as to prevent an involuntary flow of milk, unleſs the diſtending force be very great, from the accumulation of too great a quantity.

The whole ſubſtance of the nipple is very ſpongy and elaſtic: its external ſurface is uneven, and full of ſmall tubercles. The nipple is ſurrounded with a diſk, or circle of a different colour called the *areola*; and on the inſide of the ſkin, under the areola, are many ſebaceous glands, which pour out a mucus to defend the areola and nipple: for the ſkin upon theſe parts is very thin; and the nervous papillæ lying very bare, are much expoſed to irritation.

The breaſts are formed for the ſecretion of milk, which is deſtined for the nouriſhment of

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(*l*) Nuck was the firſt who obſerved that theſe tubuli communicate with each other before they reach the nipple.

the child for ſome time after its birth. This ſecretion begins to take place ſoon after delivery, and continues to flow for many months in very large quantities, if the woman ſuckles her child.

THE operation of ſuction depends on the principles of the air-pump, and the flow of milk through the lactiferous tubes is facilitated by their being ſtretched out.

THE milk, examined chemically, appears to be compoſed of oil, mucilage, and water, and of a conſiderable quantity of ſugar. The generality of phyſiologiſts have ſuppoſed that, like the chyle, it frequently retains the properties of the aliment and medicines taken into the ſtomach; but from ſome late experiments (*m*), this ſuppoſition appears to be ill founded.

## SECTION II.

### *Of the Pleura.*

THE cavity of the thorax is every where lined by a membrane of a firm texture called *pleura*. It is compoſed of two diſtinct

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(*m*) See the *Journ. de Med.* for Jan. 1781.

portions or bags, which, by being applied to each other laterally, form a ſeptum called *mediaſtinum*, which divides the cavity into two parts, and is attached poſteriorly to the vertebræ of the back, and anteriorly to the ſternum.—But the two laminæ of which this ſeptum is formed, do not every where adhere to each other; for at the lower part of the thorax they are ſeparated, to afford a lodgment to the heart; and at the upper part of the cavity, they receive between them the thymus.

THE pleura is plentifully ſupplied with arteries and veins from the internal mammary, and the intercoſtals. Its nerves, which are very inconſiderable, are derived chiefly from the dorſal and intercoſtal nerves.

THE ſurface of the pleura, like that of the peritonæum and other membranes lining cavities, is conſtantly bedewed with a ſerous moiſture (*n*), which prevents adheſions of the viſcera.

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(*n*) When this fluid is exhaled in too great a quantity, or is not properly carried off, it accumulates and conſtitutes the *hydrops pectoris*.

The mediaſtinum, by dividing the breaſt into two cavities, obviates many inconveniencies, to which we ſhould otherwiſe be liable. It prevents the two lobes of the lungs from compreſſing each other when we lie on one ſide; and conſequently contributes to the freedom of reſpiration, which is diſturbed by the leaſt preſſure on the lungs.—If the point of a ſword penetrates between the ribs into the cavity of the thorax, the lungs on that ſide ceaſe to perform their office, becauſe the air being admitted through the wound, prevents the dilatation of that lobe, while the other lobe, which is ſeparated from it by the mediaſtinum, remains unhurt, and continues to perform its function as uſual.

## SECTION III.

### *Of the Thymus.*

THE *thymus* is a glandular ſubſtance, the uſe of which is not perfectly aſcertained, its excretory duct not having yet been diſcovered. It is of an oblong figure, and is larger in the fœtus, and in young children than in adults, being ſometimes nearly effaced in very old ſubjects. It is placed in the upper part of the thorax, between the two laminæ of the mediaſtinum; but at firſt is not altogether contained within the cavity of the cheſt, being found to border upon the upper extremity of the ſternum.

## SECTION IV.

### *Of the Diaphragm.*

THE cavity of the thorax is ſeparated from that of the abdomen, by a fleſhy and membranous ſeptum called the *diaphragm* or *midriff*. The greateſt part of it is compoſed of muſcular fibres; and on this account, ſyſtematic writers uſually place it very properly among the muſcles.—Its middle part is tendinous, and it is covered by the pleura above, and by the peritonæum below.—It ſeems to have been improperly named *ſeptum tranſverſum*, as it it does not make a plane, tranſverſe diviſion of the two cavities, but forms a kind of vault, the fore-part of which is attached to the ſternum.—Laterally it is fixed to the laſt of the true ribs, and to all the falſe ribs; and its lower and poſterior part is attached to the vertebræ lumborum, where it may be ſaid to be divided into two portions or *crura* (*o*).

The principal arteries of the diaphragm are derived from the aorta, and its veins paſs into the vena cava.—Its nerves are chiefly derived from the cervical pairs.—It affords a paſſage to the vena cava through its tendinous part, and to the œſophagus through its fleſhy portion.—The aorta paſſes down behind it between its *crura*.

The diaphragm not only ſerves to divide the thorax from the abdomen, but by its muſcular ſtructure, is rendered one of the chief agents in reſpiration.—When its fibres contract, its convex ſide which is turned towards the thorax, becomes gradually flat, and by increaſing the cavity of the breaſt, affords room for a complete dilatation of the lungs, by means of the air which is then drawn into them by

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(*o*) Anatomical writers have uſually deſcribed the diaphragm, as being made up of two muſcles united by a middle tendon; and theſe two portions or crura, form what they ſpeak of as the *inferior muſcle*, ariſing from the ſides and fore-part of the vertebræ.

the act of *inſpiration.*—The fibres of the diaphragm then relax, and as it reſumes its former ſtate, the cavity of the thorax becomes gradually diminiſhed, and the air is driven out again from the lungs, by a motion contrary to the former one, called exſpiration.

IT is in ſome meaſure by means of the diaphragm, that we void the fæces at the anus, and empty the urinary bladder.—Beſides theſe offices, the acts of coughing, ſneezing, ſpeaking, laughing, gaping, and ſighing, could not take place, without its aſſiſtance; and the gentle preſſure, which all the abdominal viſcera receive from its conſtant and regular motion, cannot fail to aſſiſt in the performance of the ſeveral functions, which were aſcribed to thoſe viſcera.

## SECTION V.

### *Of the Trachea.*

THE *trachea* or *windpipe*, is a cartilaginous and membranous canal, through which the air paſſes into the lungs.—Its upper part, which is called the *larynx*, is compoſed of five cartilages. The uppermoſt and ſmalleſt of theſe cartilages, is placed over the *glottis* or mouth of the larynx, and is called *epiglottis*, which has been before ſpoken of, as cloſing the paſſage to the lungs in the act of ſwallowing. The ſides of the larynx are compoſed of the two *arytenoide* cartilages, which are of a very complex figure, not eaſy to be deſcribed. The anterior and larger part of the larynx is made up of two cartilages, one of which is called *thyroides* or *ſcutiformis*, from its being ſhaped like a buckler; and the other *cricoides* or *annularis*, from its reſembling a ring. Both theſe cartilages may be felt immediately under the ſkin, at the fore-part of the throat, and the *thyroides*, by its convexity, forms an eminence called *pomum adami*, which is uſually more conſiderable in the male than in the female ſubject.

All theſe cartilages are united to each other by means of very elaſtic, ligamentous fibres; and are enabled by the aſſiſtance of their ſeveral muſcles, to dilate or contract the paſſage of the larynx, and to perform that variety of motion which ſeems to point out the larynx, as the principal organ of the voice; for when the air paſſes out through a wound in the trachea, it produces no ſound.

These cartilages are moiſtened by a mucus, which ſeems to be ſecreted by minute glands ſituated near them.—The upper part of the trachea, and the cricoid and thyroid cartilages, are in ſome meaſure covered anteriorly by a conſiderable body, which is ſuppoſed to be of a glandular ſtructure, and from its ſituation is called the *thyroid gland;* though its excretory duct has not yet been diſcovered, or its real uſe aſcertained.

The glottis is interiorly covered by a very fine membrane, which is moiſtened by a conſtant ſupply of a watery fluid.—From the larynx, the canal begins to take the name of *trachea* or *aſpera arteria*, and extends from thence as far down as the fourth or fifth vertebra of the back, where it divides into two branches, which are the right and left bronchial tube.—Each of theſe *bronchi* (*p*), ramifies through the ſubſtance

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(*p*) The right bronchial tube is uſually found to be ſomewhat ſhorter and thicker than the left; and M. Portal, who has publiſhed a memoir on the action of the lungs ſubſtance of that lobe of the lungs, to which it is diſtributed, by an infinite number of branches, which are formed of cartilages ſeparated from each other like thoſe of the trachea, by an intervening membranous and ligamentary ſubſtance. Each of theſe cartilages is of an angular figure; and as they become gradually leſs and leſs in their diameter, the lower ones are in ſome meaſure received into thoſe above them, when the lungs after being inflated, gradually collapſe by the air being puſhed out from them in expiration.—As the branches of the bronchi become more minute, their cartilages become more and more angular and membranous, till at length they are found to be perfectly membranous, and at laſt become inviſible.

The trachea is furniſhed with fleſhy or muſcular fibres, ſome of which paſs through its whole extent longitudinally, while the others

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lungs on the aorta in reſpiration, obſerves, that the left bronchial tube is cloſely contracted by the aorta; and from ſome experiments, he is induced to conclude, that in the firſt reſpirations, the air only enters into the right lobe of the lungs.—Memoires de l'Academie Royale des Sciences, 1769.

are carried round it in a circular direction; ſo that by the contraction or relaxation of theſe fibres, it is enabled to ſhorten or lengthen itſelf, and likewiſe to dilate or contract the diameter of its paſſage.

The trachea and its branches, in all their ramifications, are furniſhed with a great number of ſmall glands which are lodged in their cellular ſubſtance, and diſcharge a mucous fluid on the inner ſurface of theſe tubes.

The cartilages of the trachea, by keeping it conſtantly open, afford a free paſſage to the air, which we are obliged to be inceſſantly reſpiring; and its membranous part, by being capable of contraction and dilatation, enables us to receive and expel the air in a greater or leſs quantity, and with more or leſs velocity, as may be required in ſinging or in declamation. This membranous ſtructure of the trachea poſteriorly, ſeems likewiſe to aſſiſt in the deſcent of the food, by preventing that impediment to its paſſage down the œſophagus, which might be expected, if the cartilages were complete rings.

The trachea receives its arteries from the carotid and ſubclavian arteries, and its veins paſs into the jugulars.—Its nerves ariſe from the recurrent branch of the eighth pair, and from the cervical plexus.

## SECTION VI.

### *Of the Lungs.*

THE lungs fill the greater part of the cavity of the breaſt. They are of a ſoft and ſpongy texture, and are divided into two lobes, which are ſeparated from each other by the mediaſtinum, and are externally covered by a production of the pleura. Each of theſe is divided into two or three leſſer lobes; and we commonly find three in the right ſide of the cavity, and two in the left.

To diſcover the ſtructure of the lungs, it is required to follow the ramifications of the bronchi, which were deſcribed in the laſt ſection.—Theſe becoming gradually more and more minute, at length terminate in the cellular ſpaces or veſicles, which make up the greateſt part of the ſubſtance of the lungs, and readily communicate with each other.

The lungs ſeem to poſſeſs but little ſenſibility. Their nerves, which are ſmall, and few in number, are derived from the intercoſtal and eighth pair. This laſt pair having reached the thorax, ſends off a branch on each ſide of the trachea, called the *recurrent*, which reaſcends at the back of the trachea, to which it furniſhes branches in its aſcent, as well as to the œſophagus, but it is chiefly diſtributed to the larynx and its muſcles. By dividing this recurrent nerve at its origin, an animal is deprived of its voice.

There are two ſeries of arteries which carry blood to the lungs, theſe are the *arteriæ bronchiales*, and the pulmonary artery.

The *arteriæ bronchiales*, begin uſually by two branches, one of which commonly ariſes from the intercoſtal, and the other from the trunk of the aorta: but ſometimes there are three of theſe arteries, and in ſome ſubjects only one.—The uſe of theſe arteries is to ſerve for the nouriſhment of the lungs, and their ramifications are ſeen creeping every where on the branches of the bronchi.—The blood is brought back from them by the bronchial vein into the vena azygos.

The pulmonary artery and vein are not intended for the nouriſhment of the lungs, but the blood in its paſſage through them, is deſtined to undergo ſome changes, or to acquire certain eſſential properties (from the action of the air), which it has loſt in its circulation through the other parts of the body. The pulmonary artery receives the blood from the right ventricle of the heart, and dividing into two branches, accompanies the bronchi every where, by its ramifications through the lungs; and the blood is afterwards conveyed back by the pulmonary vein, which gradually forming a conſiderable trunk, goes to empty itſelf into the left ventricle of the heart; ſo that the quantity of blood which enters into the lungs, is perhaps greater than that which is ſent in the ſame proportion of time, through all the other parts of the body.

## SECTION VII.

### *Of Reſpiration.*

RESPIRATION conſtitutes one of thoſe functions which are properly termed vital, as being eſſential to life; for to live and to breathe are in fact ſynonymous terms. It conſiſts in an alternate contraction and dilatation of the thorax, by firſt inſpiring air into the lungs, and then expelling it from them in exſpiration.

IT will perhaps be eaſy to diſtinguiſh and point out the ſeveral phænomena of reſpiration; but to explain their phyſical cauſe will be attended with difficulty; for it will naturally be enquired, how the lungs, when emptied of the air, and contracted by exſpiration, become again inflated, they themſelves being perfectly paſſive?—How the ribs are elevated in oppoſition to their own natural ſituation? and why the diaphragm is contracted downwards towards the abdomen? Were we to aſſert that the air, by forcing its way into the cavity of the lungs, dilated them, and conſequently elevated the ribs, and preſſed down the diaphragm, we ſhould ſpeak erroneouſly. What induces the firſt inſpiration, it is not eaſy to aſcertain ; but after an animal has once reſpired, it would ſeem likely that the blood after expiration finding its paſſage through the lungs obſtructed, becomes a *ſtimulus*, which induces the intercoſtal muſcles and the diaphragm to contract, and enlarge the cavity of the thorax, in conſequence perhaps of a certain nervous influence, which we will not here attempt to explain. The air then ruſhes into the lungs ; every branch of the bronchial tubes, and all the cellular ſpaces into which they open, become fully dilated ; and the pulmonary veſſels being equally diſtended, the blood flows through them with eaſe. But as the ſtimulus, which firſt occaſioned this dilatation ceaſes to operate, the muſcles gradually contract, the diaphragm riſes upwards again, and diminiſhes the cavity of the cheſt ; the ribs return to their former ſtate, and as the air paſſes out in exſpiration, the lungs gradually collapſe, and a reſiſtance to the paſſage of the blood again takes place. But the heart continuing to receive and expel the blood, the pulmonary artery begins again to be diſtended, the ſtimulus is renewed, and the ſame proceſs is repeated, and continues to be repeated, in a regular ſucceſſion during life: for though the muſcles of reſpiration, having a mixed motion, are, (unlike the heart) in ſome meaſure dependent on the will, yet no human being, after having once reſpired, can live many moments without it.—In an attempt to hold one's breath, the blood ſoon begins to diſtend the veins, which are unable to empty their contents into the heart; and we are able only, during a very little time, to reſiſt the ſtimulus to inſpiration. In drowning, the circulation ſeems to be ſtopped upon this principle; and in hanging, the preſſure made on the jugular veins, may co-operate with the ſtoppage of reſpiration in bringing on death.

TILL within theſe few years, phyſiologiſts were entirely ignorant of the uſe of eſpiration. It was at length diſcovered, in part, by the illuſtrious Dr. Prieſtley. He found that the air expired by animals was phlogiſticated; and that air was fitter for reſpiration, or for ſupporting animal life, in proportion as it was freer from the phlogiſtic principle. It had long been obſerved, that the blood in paſſing through the lungs acquired a more florid colour. He therefore ſuſpected, that it was owing to its having imparted phlogiſton to the air: and he ſatisfied himſelf of the truth of this idea by experiments, which ſhewed, that the craſſamentum of extravaſated blood, phlogiſticated air in proportion as it loſt its dark colour. He farther found, that blood thus reddened had a ſtrong attraction for phlogiſton; inſomuch that it was capable of taking it from phlogiſticated air, thereby becoming of a darker colour. From hence it appeared that the blood, in its circulation through the arterial ſyſtem, imbibes a conſiderable quantity of phlogiſton, which is diſcharged from it to the air in the lungs.

THIS diſcovery has ſince been proſecuted by two very ingenious phyſiologiſts, Dr. Crawford, and Mr. Elliot. It had been ſhown by profeſſors Black and Irvine, that different bodies have different capacities for containing fire. For example, that oil, and water, when equally hot to the ſenſe, and the thermometer contain different proportions of that principle; and that unequal quantities of it are required, in order to raiſe thoſe ſubſtances to like temperatures. The enquiries of Dr. Crawford,

ford, and Mr. Elliot, tend to prove, that the capacities of bodies for containing fire are diminiſhed by the addition of phlogiſton, and increaſed by its ſeparation: the capacity of calx of antimony, for example, being greater than that of the antimony itſelf. Common air contains a great quantity of fire; combuſtible bodies very little. In combuſtion, a double elective attraction takes place; the phlogiſton of the body being transferred to the air, the fire contained in the air to the combuſtible body. But as the capacity of the latter is not increaſed ſo much as that of the former is diminiſhed, only part of the extricated fire will be abſorbed by the body. The remainder therefore will raiſe the temperature of the compound; and hence we may account for the heat attending combuſtion. As the uſe of reſpiration is to dephlogiſticate the blood, it ſeems probable, that a like double elective attraction takes place in this proceſs; the phlogiſton of the blood being transferred to the air, and the fire contained in the air to the blood; but with this difference, that the capacities being equal, the whole of the extricated fire is abſorbed by the latter. The blood in this ſtate circulating through the body, imbibes phlogiſton, and of courſe gives out its fire; part only of which is abſorbed by the parts furniſhing the phlogiſton, the remainder, as in combuſtion, becoming ſenſible; and is therefore the cauſe of the heat of the body, or what is called animal heat.

In confirmation of this doctrine it may be obſerved, that the venous blood contains leſs fire than the arterial; combuſtible bodies leſs than incombuſtible ones; and that air contains leſs of this principle, according as it is rendered, by combination with phlogiſton, leſs fit for reſpiration *.

In aſcending very high mountains, reſpiration is found to become ſhort and frequent, and ſometimes to be attended with a ſpitting of blood.—Theſe ſymptoms ſeem to be occaſioned by the air being too rare and thin to dilate the lungs ſufficiently; and the blood gradually accumulating in the pulmonary veſſels, ſometimes burſts through their coats, and is brought up by coughing.—This has

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* See Crawford's *Experiments and Obſervations on Animal Heat*, and Elliot's *Philoſophical Obſervations.*

likewiſe been accounted for in a different way, by ſuppoſing that the air contained in the blood, not receiving an equal preſſure from that of the atmoſphere, expands, and at length ruptures the very minute branches of the pulmonary veſſels; upon the ſame principle that fruits and animals put under the receiver of an air-pump, are ſeen to ſwell as the outer air becomes exhauſted. But Dr. Darwin of Litchfield, has lately publiſhed ſome experiments, which ſeem to prove, that no air or elaſtic vapour does exiſt in the blood-veſſels, as has been generally ſuppoſed; and he is induced to impute the ſpitting of blood, which has ſometimes taken place in aſcending high mountains, to accident, or to violent exertions; as it never happens to animals that are put into the exhauſted receiver of an air-pump, where the diminution of preſſure is many times greater, than on the ſummit of the higheſt mountains.

## SECTION VIII.

### *Of the Voice.*

RESPIRATION has already been deſcribed as affording us many advantages; and next to that of life, its moſt important uſe ſeems to be that of forming the voice and ſpeech. The ancients, and almoſt all the moderns, have conſidered the organ of ſpeech as a kind of muſical inſtrument, which may be compared to a flute, to an hautboy, to an organ, *&c.* and they argue after the following manner.—

THE trachea, which begins at the root of the tongue, and goes to terminate in the lungs, may be compared to the pipe of an organ, the lungs dilating like bellows during the time of inſpiration; and as the air is driven out from them in expiration, it finds its paſſage ſtraitened by the cartilages of the larynx, againſt which it ſtrikes.—As theſe cartilages are more or leſs elaſtic, they occaſion in their turn more or leſs vibration in the air, and thus produce the ſound of the voice; the variation in the ſound and tone of which, depends on the ſtate of the glottis, which when ſtraitened produces an acute tone, and a grave one when dilated.

THE late M. Ferein communicated to the French Academy of Sciences, a very ingenious theory on the formation of the voice. He conſidered the organ of the voice as a *ſtring*, as well as a *wind* inſtrument—ſo that what art has hitherto been unable to conſtruct, and what both the fathers Merſenne and Kircher ſo much wiſhed to ſee, M. Ferein imagined he had at length diſcovered in the human body.—He obſerves, that there are at the edges of the glottis certain tendinous chords, placed horizontally acroſs it, which are capable of conſiderable vibration, ſo as to produce ſound, in the ſame manner as it is produced by the ſtrings of a violin or a harpſichord: and he ſuppoſes that the air as it paſſes out from the lungs, acts as a bow on theſe ſtrings, while the efforts of the breaſt and lungs regulate its motion, and produce the variety of tones. So that according to this ſyſtem, the variation in the voice is not occaſioned by the dilatation or contraction of the glottis, but by the diſtenſion or relaxation of theſe ſtrings, the ſound being more or leſs acute, in proportion as they are more or leſs ſtretched out. Another writer on this ſubject ſuppoſes, that the organ of voice is a double inſtrument, which produces in uniſon two ſounds of a different nature—one by means of the air, and the other by means of the chords of the glottis. Neither of theſe ſyſtems, however, are univerſally adopted. They are both liable to inſuperable difficulties, ſo that the manner in which the voice is formed, has never yet been ſatisfactorily aſcertained; we may obſerve, however, that the ſound produced by the glottis is not articulated. To effect this, it is required to paſs through the mouth, where it is differently modified by the action of the tongue, which is either puſhed againſt the teeth, or upwards towards the palate; detaining it in its paſſage, or permitting it to flow freely, by contracting or dilating the mouth.

## SECTION IX.

### *Of Dejection.*

BY *dejection*, we mean the act of voiding the fæces at the anus; and an account of the manner in which this is conducted was reſerved for this part of the work, becauſe it ſeemed to require a knowledge of reſpiration, to be perfectly underſtood.

THE inteſtines were deſcribed as having a periſtaltic motion, by which the fæces were gradually advancing towards the anus. Now whenever the fæces are accumulated in the inteſtinum rectum in a ſufficient quantity to become troubleſome, either by their weight or acrimony, they excite a certain uneaſineſs which induces us to go to ſtool.—To effect this, we begin by making a conſiderable inſpiration, in conſequence of which the diaphragm is carried downwards towards the lower belly; the abdominal muſcles are at the ſame time contracted in obedience to the will, and the inteſtines being compreſſed on all ſides, the re-

ſtance

ſiſtance of the *ſphincter* is overcome, and the fæces paſs out at the anus, which is afterwards drawn up by its longitudinal fibres, which are called *levatores ani*, and then by means of its *ſphincter*, is again contracted; but it ſometimes happens, as in dyſenteries, for inſtance, that the fæces are very liquid, and have conſiderable acrimony; and then the irritation they occaſion is more frequent, ſo as to promote their diſcharge, without any preſſure from the diaphragm or abdominal muſcles; and ſometimes involuntarily, as is the caſe when the ſphincter becomes paralytic.

## SECTION X.

### *Of the Pericardium, and of the Heart and its Auricles.*

THE two membranous bags of the pleura, which were deſcribed as forming the mediaſtinum, recede one from the other, ſo as to afford a lodgement to a firm membranous ſac, in which the heart is ſecurely lodged; this ſac, which is the *pericardium*, appears to be compoſed of two tunics, united to each other by cellular membrane.—The outer coat, which in thick, and in ſome places of a tendinous complexion, is a production of the mediaſtinum; the inner coat, which is extremely thin, is reflected over the auricles and ventricles of the heart, in the ſame manner as the tunica conjunctiva, after lining the eye-lids, is reflected over the eye.

This bag adheres to the tendinous part of the diaphragm, and contains a coagulable lymph, the *liquor pericardii*, which ſerves to lubricate the heart and facilitate its motions; and ſeems to be ſecreted and abſorbed in the ſame manner, as it is in the other cavities of the body.

The arteries of the pericardium are derived from the phrenic, and its veins paſs into veins of the ſame name—its nerves are likewiſe branches of the phrenic.

The ſize of the pericardium is adapted to that of the heart, being uſually large enough to contain it looſely. As its cavity does not extend to the ſternum, the lungs cover it in inſpiration; and as it every where inveſts the heart, it effectually ſecures it from being injured by lymph, pus, or any other fluid, extravaſated into the cavities of the thorax.

## *Of the Heart.*

THE heart is a hollow muſcle of a conical ſhape, ſituated tranſverſely between the two laminæ of the mediaſtinum, at the lower part of the thorax; having its *baſis* turned towards the right ſide, and its point or *apex* towards the left.—Its lower ſurface is ſomewhat flattened towards the diaphragm. Its baſis, from which the great veſſels originate, is covered with fat, and it has two hollow and fleſhy appendages, called *auricles*.—Round theſe ſeveral openings, the heart ſeems to be of a firm, ligamentous texture, from which all its fibres ſeem to originate; and as they advance from thence towards the apex, the ſubſtance of the heart ſeems to become thinner.

THE heart includes two cavities or *ventricles*, which are ſeparated from each other by a fleſhy ſeptum; one of theſe is called the *right*, and the other the *left ventricle*; though perhaps,

haps, with reſpect to their ſituation, it would be more proper to diſtinguiſh them into the *anterior* and *poſterior ventricles.*

The heart is exteriorly covered by a very fine membrane; and its ſtructure is perfectly muſcular or fleſhy, being compoſed of fibres which are deſcribed as paſſing in different directions; ſome as being extended longitudinally from the baſis to the apex—others, as taking an oblique or ſpiral courſe; and a third ſort as being placed in a tranſverſe direction (*y*).—Within the two ventricles we obſerve ſeveral furrows, and there are likewiſe tendinous ſtrings, which ariſe from fleſhy *columnæ* in the two cavities, and are attached to the valves of the auricles—that the uſe of theſe, and the other valves of the heart, may be underſtood, it muſt be obſerved, that four large veſſels paſs out from the baſis of the heart, *viz.* two arteries and two veins; and that each of theſe veſſels is furniſhed with a thin membranous production, which is attached all round to the

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(*y*) Authors differ about the courſe and diſtinctions of theſe fibres;—and it ſeems right to obſerve, that the ſtructure of the heart being more compact than that of other muſcles, its fibres are not eaſily ſeparated.

borders of their ſeveral orifices, from whence hanging looſely down, they appear to be divided into two or three diſtinct portions.—But as their uſes in the arteries and veins are different, ſo are they differently diſpoſed. Thoſe of the arteries are intended to give way to the paſſage of the blood into them from the ventricles, but to oppoſe its return: and on the contrary, the valves of the veins are conſtructed ſo as to allow the blood only to paſs into the heart.—In conſequence of theſe different uſes, we find the valves of the pulmonary artery and of the aorta, attached to the orifices of thoſe veſſels, ſo as to have their concave ſurfaces turned towards the artery; and their convex ſurfaces, which mutually meet together, being placed towards the ventricle, only permit the blood to paſs one way, which is into the arteries. There are uſually three of theſe valves belonging to the pulmonary artery, and as many to the aorta, and from their figure they are called *valvulæ ſemilunares*. The communication between the two great veins and the ventricles, is by means of the two appendages or auricles, into which the blood is diſcharged; ſo that the other valves which may be ſaid to belong to the veins, are placed in each ventricle, where the auricle opens into it. The valves in the right ventricle are uſually three in number, and are named *valvulæ tricuſpides*; but in the left ventricle, we commonly obſerve only two, and theſe are the *valvulæ mitrales*. The membranes which form theſe valves in each cavity, are attached ſo as to project ſomewhat forward, and both the *tricuſpides* and the *mitrales* are connected with the tendinous ſtrings, which were deſcribed as ariſing from the fleſhy *columnæ*. By the contraction of either ventricle, the blood is driven into the artery which communicates with that ventricle, and theſe tendinous ſtrings being gradually relaxed, as the ſides of the cavity are brought nearer to each other, the valves naturally cloſe the opening into the auricle, and the blood neceſſarily directs its courſe into the then only open paſſage, which is into the artery; but after this contraction, the heart becomes relaxed, the tendinous ſtrings are again ſtretched out, and drawing the valves of the auricle downwards, the blood is poured by the veins into the ventricle, from whence, by another contraction, it is again thrown into the artery, as will be deſcribed hereafter. The right ventricle is not quite ſo long, though ſomewhat larger than the left, but the latter has more ſubſtance than the other; and this ſeems to be, becauſe it is intended to tranſmit the blood to the moſt diſtant parts of the body, whereas the right ventricle diſtributes it only to the lungs.

The heart receives its nerves from the par vagum and the intercoſtals. The arteries which ſerve for its nouriſhment, are two in number, and ariſe from the aorta. They ſurround in ſome meaſure the baſis of the heart, and from this courſe are called the *coronary arteries.*— From theſe arteries the blood is returned by veins of the ſame name into the auricles, and even into the ventricles.

The muſcular bags called the *auricles*, are ſituated at the baſis of the heart, at the ſides of each other; and correſponding with the two ventricles, are like thoſe two cavities, diſtinguiſhed into *right* and *left*. Theſe ſacs, which are interiorly unequal, have externally a jagged appendix, which from its having been compared to the extremity of an ear, has given them their name of *auricles.*

## *Angiology, or a Deſcription of the Blood-veſſels.*

The heart has been deſcribed as contracting itſelf, and throwing the blood from its two ventricles into the pulmonary artery and the aorta, and then as relaxing itſelf and receiving a freſh ſupply from two large veins, which are the pulmonary vein, and the vena cava; we will now point out the principal diſtributions of theſe veſſels.

The *pulmonary artery* ariſes from the *right ventricle* by a large trunk, which ſoon divides into two conſiderable branches, which paſs to the right and left lobes of the lungs—each of theſe branches is afterwards divided and ſubdivided, into an infinite number of branches and ramifications, which extend through the whole ſubſtance of the lungs, and from theſe branches the blood is returned by the veins, which, contrary to the courſe of the arteries, begin by very minute canals, and gradually become larger, forming at length four large trunks called *pulmonary veins*, which terminate in the *left auricle* by one common opening, from whence the blood paſſes into the *left ventricle.* From this ſame ventricle ariſes the *aorta* or *great artery*, which at its beginning is nearly an inch in diameter: it ſoon ſends off two branches, the *coronaries*, which go to be diſtributed to the heart and its auricles. After this, at or about the third or fourth vertebra of the back, it makes a conſiderable curvature; from this curvature (*z*) ariſe three arteries; one of which ſoon divides into two branches. The firſt two are the left ſubclavian and the left carotid, and the third is a common trunk to the right ſubclavian and right cartoid; though ſometimes both the carotids ariſe diſtinctly from the aorta.

THE two *cartoids* aſcend within the ſubclavians, along the ſides of the trachea, and when they have reached the larynx, divide into two principal branches, the *internal* and *external carotid.* The firſt of theſe runs a little way

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(z) Anatomiſts uſually call the upper part of this curvature, *aorta aſcendens*, and the other part of the artery to its diviſion at the iliacs, *aorta deſcendens*; but they differ about the place where this diſtinction is to be introduced; and it ſeems ſufficiently to anſwer every purpoſe, to ſpeak only of the aorta and its curvature.

backwards in a bending direction, and having reached the under part of the ear, paſſes thro' the canal in the os petroſum, and entering into the cavity of the cranium, is diſtributed to the brain and the membranes which invelope it.—The *external carotid* divides into ſeveral branches, which are diſtributed to the larynx, pharynx, and other parts of the neck; and to the jaws, lips, tongue, eyes, temples, and all the external parts of the head.

EACH *ſubclavian* is likewiſe divided into a great number of branches. It ſends off the *vertebral artery*, which paſſes through the openings, we ſee at the bottom of the tranſverſe proceſſes of the vertebræ of the neck, and in its courſe ſends off many ramifications to the neighbouring parts. Some of its branches are diſtributed to the ſpinal marrow, and after a conſiderable inflection, it enters into the cranium, and is diſtributed to the brain.—The *ſubclavian* likewiſe ſends off branches to the muſcles of the neck and ſcapula; and the mediaſtinum, thymus, pericardium, diaphragm, the breaſts, and the muſcles of the thorax, and even of the abdomen, derive branches from the ſubclavian, which are diſtinguiſhed by different names, alluding to the parts to which they are diſtributed; as the *mammary*, the *phrenic*, the *intercoſtal*,&c. But notwithſtanding the great number of branches which have been deſcribed as ariſing from the ſubclavian, it is ſtill a conſiderable artery when it reaches the *axilla*, where it drops its former name, which alludes to its paſſage under the clavicle, and is called the *axillary* artery; from which a variety of branches are diſtributed to the muſcles of the breaſt, ſcapula, and arm.—But its main trunk taking the name of *brachialis*, runs along within ſide the arm, near the os humeri, till it reaches the joint of the fore-arm, and then it divides into two branches. This diviſion however is different in different ſubjects; for in ſome it takes place higher up, and in others lower down. When it happens to divide above the joint, it may be conſidered as a happy diſpoſition in caſe of an accident by bleeding;—for ſuppoſing the artery to be unfortunately punctured by the lancet, and that the hæmorrhage could only be ſtopt by making a ligature on the veſſel, one branch would remain unhurt, through which the blood would paſs uninterrupted to the fore-arm and hand.—One of the two branches of the *brachialis*, plunges down under the flexor muſcles, and runs along the edge of the ulna; while the other is carried along the outer ſurface of the radius, and is eaſily felt at the wriſt, where it is only covered by the common integuments. Both theſe branches commonly unite in the palm of the hand, and form an arterial arch from whence branches are detached to the fingers.

THE *aorta*, after having given off at its curvature, the *carotids* and *ſubclavians*, which convey blood to all the upper parts of the body, deſcends upon the bodies of the vertebræ a little to the left, as far as the os ſacrum, where it drops the name of *aorta*, and divides into two conſiderable branches. In this courſe from its curvature to its bifurcation, it ſends off ſeveral arteries, in the following order: 1. Two little arteries, and ſometimes only one, firſt demonſtrated by Ruyſch as going to the bronchi, and called *arteriæ bronchiales Ruyſchii.* 2. The *arteriæ œſophageæ*; theſe are commonly three or four in number. They ariſe from the fore-part of the aorta, and are diſtributed chiefly to the œſophagus. 3. The *inferior intercoſtal arteries*, which are diſtributed between the ribs in the ſame manner as the arteries of the three or four ſuperior ribs are, which are derived from the ſubclavian. Theſe arteries ſend off branches to the medulla ſpinalis. 4. The *cæliac*, which ſends off the two *diaphragmatic* or *inferior phrenic arteries*, the *coronary ſtomachic artery*, and the *hepatic artery*; which are diſtributed to the diaphragm, ſtomach, omentum, duodenum, pancreas, ſpleen, liver, and gall-bladder. 5. The *ſuperior meſenteric artery*, which is diſtributed to the meſentery and ſmall inteſtines. 6. The *emulgents*, which go to the kidneys. 7. The arteries which are diſtributed to the *glandulæ renales*. 8. The *ſpermatic*. 9. The *inferior meſenteric artery*, which ramifies through the lower portion of the meſentery and the large inteſtines.—A branch of this artery which goes to the rectum, is called the *internal hæmorrhoidal*. 10. The lumbar arteries, and a very ſmall branch called the *ſacra*, which are diſtributed to the muſcles of the loins and abdomen, and to the os ſacrum, and medulla ſpinalis.

The trunk of the aorta, when it has reached the laſt vertebra lumborum, or the os ſacrum, drops the name of *aorta*, and ſeparates into two forked branches called the *iliacs.* Each of theſe ſoon divides into two branches, one of which is called the *internal iliac*, or *hypogaſtric artery*, and is diſtributed to the urinary bladder, inteſtinum rectum, and the neighbouring parts. That branch which goes to the *rectum*, is called the *external hæmorrhoid.*—The *external iliac*, after having given off the *umbilical* artery, and the *epigaſtric*, which is diſtributed to the recti muſcles, paſſes out of the abdomen under Poupart's ligament, and takes the name of *crural artery.* It deſcends on the inner part of the thigh, cloſe to the os femoris, ſending off branches to the muſcles, and then ſinking deeper in the hind part of the thigh, reaches the ham, where it takes the name of *popliteal:* after this it ſeparates into two conſiderable branches, one of which is called the *anterior tibial* artery; the other divides into two branches, and theſe arteries all go to be diſtributed to the leg and foot.

THE blood, which is thus diſtributed by the aorta to all parts of the body, is brought back by the veins, which are ſuppoſed to be continued from the ultimate branches of arteries, and uniting together as they approach the heart, at length form the large trunks, the *vena cava aſcendens*, and *vena cava deſcendens*.

All the veins, which bring back the blood from the upper extremities, and from the head and breaſt, paſs into the *vena cava deſcendens*; and thoſe which return it from the lower parts of the body, terminate in the *vena cava aſcendens*; and theſe two *cavas* uniting together as they approach the heart, open by one common orifice into the left auricle.

It does not here ſeem to be neceſſary to follow the different diviſions of the veins, as we did thoſe of the arteries; and it will be ſufficient to remark, that in general, every artery is accompanied by its vein, and that both are diſtinguiſhed by the ſame name.—But like many other general rules, this too has its exceptions (*b*). The veins, for inſtance, which accompany the external and internal *carotid*, are not called the *carotid veins*, but the *external* and *internal jugular*.—In the thorax, there is a vein, diſtinguiſhed by a proper name, and

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(*b*) In the extremities, ſome of the deep ſeated veins, and all the ſuperficial ones, take a courſe different from that of the arteries.

this is the *azygos*, or *vena ſine pari*. This vein, which is a pretty conſiderable one, runs along by the right ſide of the vertebræ of the back, and is chiefly deſtined to receive the blood from the intercoſtals on that ſide, and to convey it into the vena cava deſcendens.—In the abdomen, we meet with a vein, which is ſtill a more remarkable one, and this is the *vena portæ*, which performs the office both of an artery and a vein.—It is formed by a re-union of all the veins which come from the ſtomach, inteſtines, omentum, pancreas and ſpleen, ſo as to compoſe one great trunk, which goes to ramify through the liver, and after having depoſited the bile, its ramifications unite and bring back into the *vena cava*, not only the blood which the *vena portæ* had carried into the liver, but likewiſe the blood from the hepatic artery. Every artery has a vein which correſponds with it; but the trunks and branches of the veins are more numerous than thoſe of the arteries.—The reaſons for this diſpoſition are perhaps not difficult to be explained—the blood in its courſe through the veins is much farther removed from the ſource and cauſe of its motion, which are in the heart, than it was when in the arteries; ſo that its courſe is conſequently leſs rapid, and enough of it could not poſſibly be brought back to the heart in the moment of its dilatation, to equal the quantity which is driven into the arteries from the two ventricles, at the time they contract; and the equilibrium, which is ſo eſſential to the continuance of life and health, would conſequently be deſtroyed, if the capacity of the veins did not exceed that of the arteries, in the ſame proportion that the rapidity of the blood's motion through the arteries, exceeds that of its return through the veins.

A LARGE artery ramifying through the body, and continued to the minute branches of veins, which gradually unite together to form a large trunk, may be compared to two trees united to each other at their tops; or rather as having their ramifications ſo diſpoſed, that the two trunks terminate in one common point; and if we farther ſuppoſe, that both theſe trunks and their branches are hollow, and that a fluid is inceſſantly circulated through them, by entering into one of the trunks and returning through the other, we ſhall be enabled to conceive how the blood is circulated through the veſſels of the human body.

Every trunk of an artery, before it divides, is nearly cylindrical, or of equal diameter through its whole length, and ſo are all its branches when examined ſeparately. But every trunk ſeems to contain leſs blood, than the many branches do, into which that trunk ſeparates; and each of theſe branches probably contains leſs blood, than the ramifications do into which it is ſubdivided: and it is the ſame with the veins; the volume of their ſeveral ramifications when conſidered together, being found to exceed that of the great trunk, which they form by their union.

The return of the blood through the veins to the heart, is promoted by the action of the muſcles, and the pulſation of the arteries. And this return is likewiſe greatly aſſiſted by the *valves*, which are to be met with in the veins, and which conſtitute one of the great diſtinctions between them and the arteries. Theſe valves, which are ſuppoſed to be formed by the inner coat of the veins, permit the blood to flow from the extremities towards the heart, but oppoſe its return. They are moſt frequent in the ſmaller veins. As the column of blood increaſes, they ſeem to become leſs neceſſary, and therefore in the vena cava aſcendens, we meet with only one valve, which is near its origin.

The arteries are compoſed of ſeveral tunics. Some writers enumerate five of theſe tunics; but perhaps we may more properly reckon only three, viz. the *nervous*, *muſcular*, and *cuticular* coats. The veins are by ſome anatomiſts deſcribed as having the ſame number of coats as the arteries; but as they do not ſeem to be irritable, we cannot with propriety ſuppoſe them to have a muſcular tunic. We are aware of Dr. Verſchuir's (*c*) experiments to prove that the jugular and ſome other veins poſſeſs a certain degree of irritability; but it is certain, that his experiments, repeated by others, have produced a different reſult; and even he himſelf allows, that ſometimes he was unable to diſtinguiſh any ſuch property in the veins. Both theſe ſeries of veſſels, are nouriſhed by ſtill more minute arteries and veins, which are ſeen creeping over their coats, and ramifying through their whole ſubſtance, and are called *vaſa vaſorum*—they have likewiſe many minute branches of nerves.

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(*c*) De Arteriarum & Venarum vi irritabili, 4to.

THE arteries are much ſtronger than the veins, and they ſeem to require this force to be enabled to reſiſt the impetus with which the blood circulates through them, and to impel it on towards the veins.

WHEN the heart contracts, it impels the blood into the arteries and ſenſibly diſtends them; and theſe veſſels again contract, as the heart becomes relaxed to receive more blood from the auricles; ſo that the cauſe of the contraction and dilatation of the *arteries*, ſeems to be eaſy to be underſtood, being owing in part to their own contractile power, and in part to the action of the heart; but in the *veins*, the effects of this impulſe not being ſo ſenſibly felt, and the veſſels themſelves having little or no contractile power, the blood ſeems to flow in a conſtant and equal ſtream; and this, together with its paſſing gradually from a ſmall channel into a larger one, ſeems to be the reaſon why the *veins* have no pulſatory motion, except the large ones near the heart; and in theſe it ſeems to be occaſioned by the motion of the diaphragm, and by the regurgitation of the blood in the *cavas*.

## SECTION XI.

### *Of the Action of the Heart, Auricles, and Arteries.*

THE *heart* at the time it contracts, drives the blood from its ventricles into the arteries; and the arteries being thus filled and diſtended, are naturally inclined to contract, the moment the heart begins to dilate and ceaſes to ſupply them with blood.—Theſe alternate motions of contraction and dilatation of the heart and arteries, are diſtinguiſhed by the names of *ſyſtole* and *diaſtole*.—When the heart is in a ſtate of contraction or *ſyſtole*, the arteries are at that inſtant diſtended with blood, and in their *diaſtole*; and it is in this ſtate we feel their pulſatory motion, which we call the *pulſe*. When the heart dilates, and the arteries contract, the blood is impelled onwards into the veins, through which it is returned back to the heart.—While the heart, however, is in its *ſyſtole*, the blood cannot paſs from the veins into the ventricles, but is detained in the auricles, which are two reſervoirs formed for this uſe, till the *diaſtole*, or dilatation of the heart takes place, and then the diſtended auricles contract, and drive the blood into the ventricles, ſo that the auricles have an alternate *ſyſtole* and *diaſtole*, as well as the heart.

ALTHOUGH both the ventricles of the heart contract at the ſame time, yet the blood paſſes from one to the other.—In the ſame moment, for inſtance, that the left ventricle drives the blood into the aorta, the right ventricle impels it into the pulmonary artery, which is diſtributed through all the ſubſtance of the lungs.—The blood is afterwards brought back into the left ventricle by the pulmonary vein, at the ſame time that the blood is returned by the cavas, into the right ventricle, from all the other parts of the body.

THIS ſeems to be the mode of action of the heart, and its veſſels; but the cauſe of this action, has, like all other intricate and intereſting ſubjects, been differently explained. It ſeems to depend on the ſtimulus made on the different parts of the heart by the blood itſelf, which by its quantity and heat, or other properties (*g*), is perhaps capable of firſt exciting that motion, which is afterwards continued through life, independent of the will, by a regular return of blood to the auricles, in a quantity proportioned to that which is thrown into the arteries.

THE heart poſſeſſes the *vis inſita*, or principle of irritability, in a much greater degree than any other muſcle of the body. The pulſe is quicker in young than in old ſubjects, becauſe the former are *cæt. par.* more irritable than the latter. Upon the ſame principle we may explain, why the pulſe is conſtantly quicker in weak than in robuſt perſons.

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(*g*) Dr. Harvey long ago ſuggeſted, that the blood is poſſeſſed of a living principle; and Mr. J. Hunter has lately endeavoured to revive this doctrine; in ſupport of which, he has adduced many ingenious arguments. The ſubject is a curious one, and deſerves to be proſecuted as an inquiry which cannot but be intereſting to phyſiologiſts.

## SECTION XII.

### *Of the Circulation.*

AFTER what has been obſerved of the ſtructure and action of the heart and its auricles, and likewiſe of the arteries and veins, there ſeem to be but very few arguments required to demonſtrate the *circulation of the blood*, which has long ſince been eſtabliſhed as a medical truth. This circulation may be defined to be a perpetual motion of the blood, in conſequence of the action of the heart and arteries, which impel it through all the parts of the body, from whence it is brought back by the veins to the heart.

A VERY ſatisfactory proof of this circulation, and a proof eaſy to be underſtood, may be deduced from the different effects of preſſure on an artery and a vein. If a ligature, for inſtance, is paſſed round an artery, the veſſel ſwells conſiderably between the ligature and the heart; whereas if we tie up a vein, it only becomes filled between the extremity and the ligature, and this is what we every day obſerve in bleeding. The ligature we paſs round the arm on theſe occaſions, compreſſes the ſuperficial veins, and the return of the blood through them being impeded, they become diſtended.—When the ligature is too looſe, the veins are not ſufficiently compreſſed, and the blood continues its progreſs towards the heart; and, on the contrary, when it is made too tight, the arteries themſelves become compreſſed, and the flow of the blood through them being impeded, the veins cannot be diſtended.

ANOTHER phænomenon, which effectually proves the circulation, is the loſs of blood that every living animal ſuſtains by opening only a ſingle artery of a moderate ſize; for it continues to flow from the wounded veſſel till the equilibrium is deſtroyed, which is eſſential to life. This truth was not unknown to the ancients, and it ſeems ſtrange that it did not lead them to a knowledge of the circulation, as it ſufficiently proves, that all the other veſſels muſt communicate with that which is opened. Galen, who lived more than 1500 years ago, drew this concluſion from it; and if we farther obſerve, that he deſcribes, (after Eraſiſtratus who flouriſhed about 450 years before him) the ſeveral valves of the heart, and determines their diſpoſition and uſes, it will appear wonderful, that a period of near 2000 years ſhould afterwards elapſe, before the true courſe of the blood was aſcertained. This diſcovery, for which we are indebted to the immortal Harvey, has thrown new lights on phyſiology, and the doctrine of diſeaſes, and conſtitutes one of the moſt important periods of anatomical hiſtory.

## SECTION XIII.

### *Of the Nature of the Blood.*

BLOOD, recently drawn from a vein into a baſon, would ſeem to be an homogeneous fluid of a red colour (*i*); but when ſuffered to reſt, it ſoon coagulates, and divides into two parts, which are diſtinguiſhed by the names of *craſſamentum* and *ſerum*. The *craſſamentum*

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(*i*) The blood, as it flows through the arteries, is obſerved to be more florid than it is in the veins; and this redneſs is acquired in its paſſage through the lungs. *Vid.* Sect. VII.

*mentum* is the red coagulum, and the *ſerum* is the water in which it floats. Each of theſe may be again ſeparated into two others; for the *craſſamentum*, by being repeatedly waſhed in warm water, gives out all its red globules, and what remains, appears to be compoſed of the *coagulable lymph* (*k*), which is a gelatinous ſubſtance, capable of being hardened by fire till it becomes perfectly horny: and if we expoſe the *ſerum* to a certain degree of heat, part of it will be found to coagulate like the white of an egg, and there will remain a clear and limpid water, reſembling urine both in its appearance and ſmell.

THE *ſerum* and *craſſamentum* differ in their proportion in different conſtitutions; in a ſtrong perſon, the craſſamentum is in a greater proportion to the ſerum, than in a weak

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(*k*) It may not be improper to obſerve, that till of late the *coagulable lymph* has been confounded with the *ſerum* of the blood, which contains a ſubſtance that is likewiſe coagulable, though only when expoſed to heat, or combined with certain chemical ſubſtances; whereas the other coagulates ſpontaneouſly, when expoſed to the air or to reſt.

one (*l*); and the ſame difference is found to take place in diſeaſes (*m*).

## SECTION XIV.

### *Of Nutrition.*

THE variety of functions which we have deſcribed as being inceſſantly performed by the living body, and the continual circula-

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(*l*) Hewſon's Experim. Enq. Part I.

(*m*) When the blood ſeparates into *ſerum* and *craſſamentum*, if the latter be covered with a cruſt of a whitiſh or buff-colour, it has been uſually conſidered as a certain proof of the blood's being in a ſtate of too great viſcidity. This appearance commonly taking place in inflammatory diſeaſes, has long ſerved to confirm the theory which aſcribes the cauſe of inflammation to lentor and obſtructions. But from the late Mr. Hewſon's experiments it appears, that when the action of the arteries is increaſed, the blood, inſtead of being more viſcid, is on the contrary, more fluid than in the ordinary ſtate, previous to inflammation: and that in conſequence of this, the *coagulable lymph* ſuffers the red globules, which are the heavieſt part of the blood, to fall down to the bottom before it coagulates; ſo that the craſſamentum is divided into two parts; one of which is found to conſiſt of the coagulable lymph alone, (in this caſe termed the *buff*), and the other, partly of this, and partly of the red globules.

tion of the blood through it, muſt neceſſarily occaſion a conſtant diſſipation of the ſeveral parts which enter into its compoſition.—In ſpeaking of the inſenſible perſpiration, we obſerved, how much was inceſſantly paſſing off from the lungs, and the ſurface of the ſkin.—The diſcharge by urine, is likewiſe every day conſiderable; and great part of the bile, ſaliva, *&c.* are excluded by ſtool.—But the *ſolid*, as well as the *fluid* parts of the body, require a conſtant renewal of nutritious particles. They are expoſed to the attrition of the fluids which are circulated through them, and the contraction and relaxation they repeat ſo many thouſand times in every day, would neceſſarily occaſion a diſſolution of the machine, if the renewal was not proportioned to the waſte.

It is eaſy to conceive how the chyle formed from the aliment, is aſſimilated into the nature of blood, and repairs the loſs of the fluid parts of our body; but how the ſolids are renewed, has never yet been ſatisfactorily explained. The nutritious parts of the blood, are probably depoſited by the arteries by exſudation through their pores into the *tela celluloſa*; and as the ſolid parts of the body are, in the embryo, only a kind of jelly, which gradually acquires the degree of conſiſtence they are found to have, when the body arrives at a more advanced age: and theſe ſame parts, which conſiſt of bones, cartilages, ligaments, muſcles, *&c.* are ſometimes reduced again by diſeaſe, to a gelatinous ſtate; we may, with ſome degree of probability, conſider the coagulable lymph as the ſource of nutrition.

If the ſupply of nouriſhment exceeds the degree of waſte, the body increaſes; and this happens in *infancy* and in *youth*: for at thoſe periods, but more particularly the former one, the fluids bear a large proportion to the ſolids; and the fibres being ſoft and yielding, are proportionably more capable of extenſion and increaſe. But when the ſupply of nutrition only equals the waſte, we neither increaſe nor decreaſe; and we find this to be the caſe, when the body has attained its full growth or *acme*: for the ſolids having then acquired a certain degree of firmneſs and rigidity, do not permit a farther increaſe of the body. But as we approach to old age, rigidity begins to be in exceſs, and the fluids (*n*) bear a much leſs proportion to the ſolids, than before. The diſſipation of the body, is greater than the ſupply of nouriſhment; many of the ſmaller veſſels become gradually impervious (*o*); and the fibres loſing their moiſture and their elaſticity, appear flaccid and wrinkled.—The lilies and the roſes diſappear, becauſe the fluids by which they were produced, can no longer reach the extremities of the capillary veſſels of the ſkin.—As theſe changes take place, the nervous power being proportionably weakened, the irritability and ſenſibility of the body, which were formerly ſo remarkable, are greatly diminiſhed; and in advanced life, the hearing, the eye-ſight, and all the other ſenſes become gradually impaired.

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(*n*) As the fluids become leſs in proportion to the ſolids, their acrimony is found to increaſe; and this may perhaps compenſate for the want of fluidity in the blood, by diminiſhing its coheſion.

(*o*) In infancy, the arteries are numerous and large, in reſpect to the veins, and the lymphatic glands are larger than at any other time of life; whereas in old age, the capacity of the venous ſyſtem exceeds that of the arteries, and the lymphatic ſyſtem almoſt diſappears.

# SECTION XV.

## *Of the Glands and Secretions.*

THE *glands* are commonly underſtood to be ſmall, roundiſh, or oval bodies, formed by the convolution of a great number of veſſels, and deſtined to ſeparate particular humours from the maſs of blood.

THEY are uſually divided into two claſſes, but it ſeems more proper to diſtinguiſh three kinds of glands, viz. the *mucous*, *conglobate*, and *conglomerate*.

THE *mucous glands*, or *follicles*, as they are moſt commonly called, are ſmall cylindrical tubes, continued from the ends of arteries. In ſome parts of the body, as in the tonſils, for example, ſeveral of theſe follicles may be ſeen folded together in one common covering, and opening into one common ſinus. Theſe follicles are the veſſels that ſecrete and pour out mucus in the mouth, œſophagus, ſtomach, inteſtines, and other parts of the body.

The *conglobate* glands are peculiar to the lymphatic ſyſtem. Every lymphatic vein paſſes through a gland of this kind in its way to the thoracic duct. They are met with in different parts of the body, particularly in the axilla, groin and meſentery, and are either ſolitary, or in diſtinct cluſters.

The *conglomerate* glands are of much greater bulk than the conglobate, and ſeem to be an aſſemblage of many ſmaller glands. Of this kind are the liver, kidnies, &c. Some of them, as the pancreas, parotids, &c. have a granulated appearance. All theſe conglomerate glands are plentifully ſupplied with blood-veſſels, but their nerves are in general, very minute, and few in number. Each little granulated portion furniſhes a ſmall tube, which unites with other ſimilar ducts, to form the common excretory duct of the gland.

The principal glands, and the humours they ſecrete, have been already deſcribed in different parts of this work; and there only remains for us to examine the general ſtructure of the glands, and to explain the mechaniſm of ſecretion.

cretion.—On the firſt of theſe ſubjects two different ſyſtems have been formed, each of which has had, and ſtill continue to have, its adherents. One of theſe ſyſtems was advanced by Malpighi, who ſuppoſed that an artery, entering into a gland, ramifies very minutely through its whole ſubſtance; and that its branches ultimately terminate in a veſicular cavity or follicle, from whence the ſecreted fluid paſſes out through the excretory duct.—This doctrine at firſt met with few opponents, but the celebrated Ruyſch, who firſt attempted minute injections with wax, afterwards diſputed the exiſtence of theſe follicles, and aſſerted, that every gland appears to be a continued ſeries of veſſels, which after being repeatedly convoluted in their courſe through its ſubſtance, at length terminate in the excretory duct. Anatomiſts are ſtill divided between theſe two ſyſtems; that of Malpighi, however, ſeems to be the beſt founded.

THE mode of ſecretion has been explained in a variety of ways, and they are all perfectly hypothetical.—In ſuch an enquiry, it is natural to aſk, how one gland conſtantly ſeparates a particular humour, while another gland ſecrets one of a very different nature from the blood?—The bile, for inſtance, is ſeparated by the liver, and the urine by the kidneys.—Are theſe ſecretions to be imputed to any particular diſpoſition in the fluids, or is their cauſe to be looked for in the ſolids?

It has been ſuppoſed, that every gland contains within itſelf a fermenting principle, by which it is enabled to change the nature of the blood it receives, and to endue it with a particular property. So that, according to this ſyſtem, the blood, as it circulates through the kidneys, becomes mixed with the fermenting principle of thoſe glands, and a part of it is converted into urine; and again, in the liver, in the ſalival and other glands, the bile, the ſaliva and other juices, are generated from a ſimilar cauſe—but it ſeems to be impoſſible for any liquor to be confined in a place expoſed to the circulation, without being carried away by the torrent of blood, every part of which would be equally affected; and this ſyſtem of fermentation has long been rejected as vague and chimerical. But as the cauſe of ſecretion continued to be looked for in the fluids, the former ſyſtem was ſucceeded by another, in which recourſe was had to the analogy of the humours.—It was obſerved, that if paper is moiſtened with water, and oil and water are afterwards poured upon it, that the water only will be permitted to paſs through it. But that, on the other hand, if the paper has been previouſly ſoaked in oil inſtead of water, the oil only, and not the water, will be filtered through it. Theſe obſervations led to a ſuppoſition, that every ſecretory organ is originally furniſhed with a humour analogous to that which it is afterwards deſtined to ſeparate from the blood; and that in conſequence of this diſpoſition, the ſecretory veſſels of the liver, for inſtance, will only admit the bilious particles of the blood, while all the other humours will be excluded. This ſyſtem is an ingenious one, but the difficulties with which it abounds, are unanſwerable. For oil and water are immiſcible, whereas the blood, as it is circulated through the body, appears to be an homogeneous fluid. Every oil will paſs through a paper moiſtened only with one kind of oil.—And wine or ſpirits mixed with water, will eaſily be filtered through a paper, previouſly ſoaked in water. Upon the ſame principle, all our humours, though differing in their other properties, yet agreeing in that of being perfectly miſcible with each other, will all eaſily paſs through the ſame filtre.—But theſe are not all the objections to this ſyſtem, the humours which are ſuppoſed to be placed in the ſecretory veſſels, for the determination of ſimilar particles from the blood, muſt be originally ſeparated without any analogous fluid; and that which happens once, may as eaſily happen always.. Again, it ſometimes happens, from a vicious diſpoſition, that humours are filtered through glands, which are naturally not intended to afford them a paſſage; and when this once has happened, it ought, according to this ſyſtem, to be expected always to do ſo; whereas this is not the caſe, and we are, after all, naturally led to ſeek for the cauſe of ſecretion in the ſolids.—It does not ſeem right to aſcribe it to any particular figure of the ſecretory veſſels, becauſe the ſoft texture of thoſe parts, does not permit them to preſerve any conſtant ſhape, and our fluids ſeem to be capable of accommodating themſelves to every kind of figure. Some have imputed it to the difference of diameter in the orifices of the different ſecretory veſſels.—To this doctrine, objections have likewiſe been raiſed;

and it has been argued, that the veſſels of the liver, for inſtance, would, upon this principle, afford a paſſage not only to the bile, but to all the other humours of leſs conſiſtence with it. In reply to this objection it has been ſuppoſed, that ſecondary veſſels exiſt, which originate from the firſt, and permit all the humours thinner than the bile to paſs through them.

EACH of theſe hypotheſes is probably very remote from the truth.

# CHAP. VI.

## *Of the Brain and its Integuments.*

THE bones of the *cranium* were deſcribed in the oſteological part of this work, as incloſing the brain, and defending it from external injury: but they are not its only protection, for when we make an horizontal ſection through theſe bones, we find this maſs every where ſurrounded by two membranes (*q*), the *dura* and *pia mater*.—The firſt of theſe lines the interior ſurface of the cranium, to which it adheres ſtrongly (*r*) at the ſutures, and at the many foramina, through which veſſels paſs be-

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(*q*) The Greeks called theſe membranes, *meninges*; but the Arabians, ſuppoſing them to be the ſource of all the other membranes of the body, afterwards gave them the names of *dura* and *pia mater*, by which they are now uſually diſtinguiſhed.

(*r*) In young ſubjects, this adheſion is greater than in adult; but even then, in the healthy ſubject, it is no where eaſily ſeparable, without breaking through ſome of the minute veſſels, by means of which it is attached to the bone.

tween it and the pericranium. The *dura mater* (*s*) is perfectly ſmooth and inelaſtic, and its inner ſurface is conſtantly bedewed with a fine pellucid fluid, which every where ſeparates it from the pia mater.—The dura mater ſends off ſeveral conſiderable proceſſes, which divide the brain into ſeparate portions, and prevent them from compreſſing each other. Of theſe proceſſes there is one ſuperior and longitudinal, called the *falx*, or *falciform proceſs*, from its reſemblance to a ſcythe. It ariſes from the ſpine of the os frontis, near the criſta galli, and extending along in the direction of the ſagittal ſuture, to beyond the lambdoidal ſuture, divides the brain into two hemiſpheres. A little below the lambdoidal ſuture, it divides into two broad wings or expanſions called the *tranſverſe* or *lateral proceſſes*, which prevents

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(*s*) This membrane is commonly deſcribed, as conſiſting of two laminæ, of which the external one is ſuppoſed to perform the office of perioſteum internum to the cranium, while the internal one forms the folds and proceſſes of the dura mater. In the natural ſtate, however, no ſuch ſeparation is apparent; like other membranes, we may indeed divide it, not into two only, but many laminæ; but this diviſion is artificial, and depends on the dexterity of the anatomiſt.

vents the lobes of the cerebrum from preſſing on the cerebellum. Beſides theſe there is a fourth, which is ſituated under the tranſverſe proceſſes, and being continued to the ſpine of the occiput, divides the cerebellum into two lobes.

The blood, after being diſtributed through the cavity of the cranium by means of the arteries, is returned, as in the other parts of the body, by veins which all paſs on to certain channels, ſituated behind theſe ſeveral proceſſes.

These canals or ſinuſes, communicate with each other, and empty themſelves into the internal jugular veins, which convey the blood into the vena cava. They are in fact triangular veins, running through the ſubſtance of the dura mater, and, like the proceſſes, are diſtinguiſhed into *longitudinal* and *lateral*; and where theſe three meet, and where the fourth proceſs paſſes off, we obſerve a fourth ſinus, which is called *torcular:* Herophilus, who firſt deſcribed it, having ſuppoſed that the blood at the union of theſe two veins, is, as it were, in a preſs.

Besides theſe four canals, which were known to the ancients, modern anatomiſts enumerate many others, by giving the appellation of *ſinuſes*, to other veins of the dura mater, which for the moſt part empty themſelves into ſome of thoſe we have juſt now deſcribed. There are the inferior longitudinal ſinus, the ſuperior and inferior petrous ſinuſes, the cavernous ſinuſes, the circular ſinus, and the anterior and poſterior occipital ſinuſes.

These ſinuſes or veins, by being conveyed thro' a thick denſe membrane, firmly ſuſpended, as the dura mater is, within the cranium, are leſs liable to rupture; at the ſame time, they are well ſupported, and by running every where along the inner ſurface of the bones, they are prevented from preſſing on the ſubſtance of the brain. To prevent too great a dilatation of them, we find filaments (called *chordæ Williſii*, from their having been firſt noticed by *Willis*) ſtretched acroſs their cavities; and the oblique manner in which the veins from the brain run through the ſubſtance of the brain into theſe channels, ſerves the purpoſe of a valve, which prevents the blood from turning back into the ſmaller and weaker veſſels of the brain.

The *pia mater* is a much ſofter and finer membrane than the *dura mater*; being exceedingly delicate, tranſparent, and vaſcular. It inveſts every part of the brain, and ſends off an infinite number of elongations, which inſinuate themſelves between the convolutions, and even into the ſubſtance of the brain. This membrane is compoſed of two laminæ, of which the exterior one is named *tunica arachnoidea*, from its thinneſs, which is equal to that of a ſpider's web. Theſe two laminæ are intimately adherent to each other at the upper part of the brain, but are eaſily ſeparable at the baſis of the brain, and through the whole length of the medulla ſpinalis. The external layer or *tunica arachnoidea*, appears to be ſpread uniformly over the ſurface of the brain, but without entering into its furrows as the inner layer does; the latter being found to inſinuate itſelf between the convolutions, and even into the interior cavities of the brain. The blood-veſſels of the brain are diſtributed through it in their way to that organ; and are therefore divided into very minute ramifications, before they penetrate the ſubſtance of the brain.

There are ſeveral parts included under the general denomination of *brain*. One of theſe, which is of the ſofteſt conſiſtence, and fills the greateſt part of the cavity of the cranium, is the *cerebrum* or *brain, properly ſo called.*—Another portion, which is ſeated in the inferior and poſterior part of the head, is the *cerebellum*; and a third, which derives its origin from both theſe, is the *medulla oblongata.*

The *cerebrum* is a medullary maſs of a moderate conſiſtence, filling up exactly all the upper part of the cavity of the cranium, and divided into two hemiſpheres, by the *falx* of the dura mater.—Each of theſe hemiſpheres is uſually diſtinguiſhed into *an anterior, a middle*, and *a poſterior lobe.* The firſt of theſe is lodged on the orbital proceſſes of the os frontis; the middle lobes lie in the middle foſſæ of the baſis of the cranium, and the poſterior lobes are placed on the tranſverſe ſeptum of the os occipitis, immediately over the cerebellum, from which they are ſeparated by the lateral proceſſes of the dura mater. Theſe two portions,

portions afford no diſtinguiſhing mark of ſeparation, and on this account Haller, and many other modern anatomiſts omit the diſtinction of middle lobe, and ſpeak only of the anterior and poſterior lobes of the brain.

The cerebrum appears to be compoſed of two diſtinct ſubſtances. Of theſe, the exterior one, which is of a greyiſh or aſh colour, is called the *cortex*, and is ſomewhat ſofter than the other, which is very white, and is called *medulla*, or *ſubſtantia alba.*

After having removed the falx, and ſeparated the two hemiſpheres from each other, we perceive a white convex body, the *corpus calloſum*, which is a portion of the medullary ſubſtance, uniting the two hemiſpheres to each other, and not inveſted by the cortex. By making an horizontal inciſion in the brain, on a level with this *corpus calloſum*, we diſcover two oblong cavities, named the *anterior* or *lateral ventricles*, one in each hemiſphere. Theſe two ventricles, which communicate with each other by a hole immediately under the plexus choroides, are ſeparated laterally, by a very fine medullary partition, called *ſeptum lucidum*, from its thinneſs and tranſparency. The lower edge of this ſeptum is fixed to the *fornix*, which is a kind of medullary arch (as its name implies) ſituated under the corpus calloſum, and nearly of a triangular ſhape. Anteriorly the fornix ſends off two medullary chords, called its *anterior crura*; which ſeem to be united to each other by a portion of medullary ſubſtance, named *commiſſura anterior cerebri*. Theſe *crura* diverging from one another, are loſt at the outer ſide of the lower and fore-part of the third ventricle. Poſteriorly the fornix is formed into two other crura, which unite with two medullary protuberances called *pedes hippocampi*, and ſometimes *cornua Ammonis*, that extend along the back part of the lateral ventricles. The concave edge of the pedes hippocampi, is covered by a medullary lamina, called *corpus fimbriatum*.

NEITHER the edges of the fornix, nor its poſterior crura, can be well diſtinguiſhed, till we have removed the *plexus choroides*. This is a production of the pia mater, which is ſpread over the lateral ventricles. Its looſe edges are collected, ſo as to appear like a vaſcular band on each ſide.

When we have removed this plexus, we diſcover ſeveral other protuberances included in the lateral ventricles. Theſe are the *corpora ſtriata*, the *thalami nervorum opticorum*, the *tubercula quadrugemina*, and the *pineal gland.*

The *corpora ſtriata* are two curved oblong eminences, that extend along the anterior part of the lateral ventricles. They derive their name from their ſtriated appearance, which is owing to an intermixture of the cortical and medullary ſubſtances of the brain. The *thalami nervorum opticorum*, are ſo called, becauſe the optic nerves ariſe chiefly from them, and they are likewiſe compoſed both of the cortex and medulla. They are ſeparated from the corpora ſtriata only by a kind of medullary chord, the *geminum centrum ſemi-circulare*. The thalami are nearly of an oval ſhape, and are ſituated at the bottom of the upper cavity of the lateral ventricles. They are cloſely united, and at their convex part ſeem to become one body.

Anteriorly, in the ſpace between the thalami, we obſerve an orifice called *vulva*; and their ſeparation from each other poſteriorly, forms another called *anus*. Both theſe openings communicate with the third ventricle. The back part of the anus is formed by a kind of medullary band, which connects the thalami to each other, and is called *commiſſura poſterior cerebri*.

BEHIND the thalami and commiſſura poſterior, we obſerve a ſmall, ſoft, greyiſh, and oval body, about the ſize of a pea. This is the *glandula pinealis*; it is deſcribed by Galen, under the name of *conarion*, and has been rendered famous by Deſcartes, who ſuppoſed it to be the ſeat of the ſoul. Galen ſeems formerly to have entertained the ſame opinion. Some modern writers have, with as little reaſon imagined, that the ſoul is placed in the corpus calloſum.

THE pineal gland reſts upon four remarkable eminences, diſpoſed in pairs, and ſeated immediately below it. Theſe tubercles, which by the ancients were called *teſtes* and *nates*, have ſince the time of Winſlow, been more commonly named *tubercula quadrugemina*.

UNDER the thalami we obſerve another cavity, the third ventricle, which terminates anteriorly in a ſmall medullary canal, the *infundibulum*, that leads to the *glandula pituitaria*. It has been doubted, whether the infundibulum is really hollow, but ſome late experiments on this part of the brain (*a*) by profeſſor Murray of Upſal, clearly prove it to be a medullary canal, ſurrounded by both laminæ of the pia mater. After freezing the brain, this channel was found filled with ice; and de Haën tells (*b*) us, he found it dilated, and filled with a calcareous matter.

The ſoft ſpongy body in which the infundibulum terminates, was by the ancients ſuppoſed to be of a glandular ſtructure, and deſtined to filter the ſeroſity of the brain. Spigelius pretended to have diſcovered its excretory duct, but it ſeems certain, that no ſuch duct exiſts. It is of an oblong ſhape, compoſed as it were of two lobes. In ruminant animals it is much larger than in man.

From the poſterior part of the third ventricle, we ſee a ſmall groove or channel, deſcending obliquely backwards. This channel, which

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(*a*) Diſp. de Infundibulo Cerebri.

(*b*) Ratio Med. Tom. VI. p. 271.

which is called the *aquæduct of Sylvius*, though it was known to the ancients, opens into another cavity of the brain, placed between the cerebellum and medulla oblongata, and called the *fourth ventricle*.

The *cerebellum*, which is divided into two lobes, is commonly ſuppoſed to be of a firmer texture than the cerebrum; but the truth is, that in the greater number of ſubjects, there appears to be no ſenſible difference in the conſiſtence of theſe two parts. It has more of the cortical than of the medullary ſubſtance in its compoſition.

The furrow that divides the two lobes of the cerebellum, leads anteriorly to a proceſs, compoſed of medullary and cortical ſubſtances, covered by the pia mater, and which, from its being divided into numerous furrows, reſembling the rings of the earth-worm, is named *proceſſus vermiformis*. This proceſs forms a kind of ring in its courſe between the lobes.

The ſurface of the cerebellum does not afford thoſe circumvolutions which appear in the cerebrum; but, inſtead of theſe, we obſerve

ſerve a great number of minute furrows, running parallel to each other, and nearly in a tranſverſe direction. The pia mater inſinuates itſelf into theſe furrows.

When we cut into the ſubſtance of the cerebellum, from above downwards, we find the medullary part running in a kind of ramifying courſe, and exhibiting an appearance that has gotten the name of *arbor vitæ.* Theſe ramifications unite, to form a medullary trunk, the middle, anterior, and moſt conſiderable part of which, forms two proceſſes, the *crura cerebelli,* which unite with the *crura cerebri,* to form the medulla oblongata. The reſt furniſhes two other proceſſes, which loſe themſelves under the nates, and thus unite the lobes of the cerebellum to the poſterior part of the cerebrum. Under the nates we obſerve a tranſverſe medullary line, or *linea alba,* running from one of theſe proceſſes to the other; and between them we find a very thin medullary lamina, covered with the pia mater, which the generality of anatomiſts have (though ſeemingly without reaſon) conſidered as a valve formed for cloſing the communication between the fourth ventricle and the aqueductus Sylvii. Vieuſſens named it *valvula major cerebri*.

The *medulla oblongata* is ſituated in the middle, lower, and poſterior part of the cranium, and may be conſidered as a production or continuation of the whole medullary ſubſtance of the cerebrum and cerebellum, being formed by the union of two conſiderable medullary proceſſes of the cerebrum, called *crura cerebri*, with two other ſmaller ones from the cerebellum, which were juſt now ſpoken of under the name of *crura cerebelli*.

The crura cerebri ariſe from the middle and lower part of each hemiſphere. They are ſeparated from each other at their origin, but are united below, where they terminate in a middle protuberance, the *pons Varolii*, ſo called, becauſe Varolius compared it to a bridge. This name, however, can convey no idea of its real appearance. It is, in fact, nothing more than a medullary protuberance, nearly of a ſemi-ſpherical ſhape, which unites the crura cerebri to thoſe of the cerebellum.

Between the crura cerebri, and near the anterior edge of the pons Varolii, are two tubercles, compoſed externally of medullary, and internally of cineritious ſubſtance, to which Euſtachius firſt gave the name of *eminentiæ mammillares.*

Along the middle of the poſterior ſurface of the medulla oblongata, where it forms the anterior part of the fourth ventricle, we obſerve a kind of furrow which runs downwards and terminates in a point. About an inch above the lower extremity of this fiſſure, ſeveral medullary filaments are to be ſeen running towards it on each ſide, in an oblique direction, ſo as to give it the appearance of a writing-pen; hence it is called *calamus ſcriptorius.*

From the poſterior part of the *pons Varolii*, the medulla oblongata deſcends obliquely backwards; at its fore-part, immediately behind the *pons Varolii*, we obſerve two pair of eminences, which were deſcribed by Euſtachius, but received no particular appellation till the time of Vieuſſens, who gave them the names of *corpora olivaria*, and *corpora pyramidalia.* The former are the outermoſt, being placed one on each ſide. They are nearly of an oval ſhape, and are compoſed of medulla, with ſtreaks of cortical ſubſtance. Between theſe are the corpora pyramidalia, each of which terminates in a point. In the human ſubject theſe four eminences are ſometimes not eaſily diſtinguiſhed.

THE *medulla ſpinalis*, or *ſpinal marrow*, which is the name given to the medullary chord that is extended down the vertebral canal, from the great foramen of the occipital bone, to the bottom of the laſt lumbar vertebra, is a continuation of the medulla oblongata. Like the other parts of the brain, it is inveſted by the dura and pia mater. The firſt of theſe in its paſſage out of the cranium, adheres to the foramen of the os occipitis. Its connection with the ligamentary ſubſtance that lines the cavity of the ſpine, is only by means of cellular membrane, but between the ſeveral vertebræ, where the nerves paſs out of the ſpine, it ſends off prolongations, which adhere ſtrongly to the vertebral ligaments. Here, as in the cranium, the dura mater has its ſinuſes or large veins. Theſe are two in number, and are ſeen running on each ſide of the medullary column, from the foramen magnum of the os occipitis, to the lower part of the os ſacrum. They communicate together by ramifying branches at each vertebra, and terminate in the vertebral, intercoſtal, and ſacral veins.

The pia mater is connected with the dura mater by means of a thin tranſparent ſubſtance, which from its indentations between the ſpinal nerves, has obtained the name of *ligamentum denticulatum*. It is ſomewhat firmer than the tunica arachnoidea, but in other reſpects reſembles that membrane. Its uſe is to ſupport the ſpinal marrow, that it may not affect the medulla oblongata by its weight.

The ſpinal marrow itſelf is externally of a white colour, but upon cutting into it we find its middle-part compoſed of a darker coloured maſs, reſembling the cortex of the brain. When the marrow has reached the firſt lumbar vertebra, it becomes extremely narrow, and at length terminates in an oblong protuberance, from the extremity of which the pia mater ſends off a prolongation or ligament, reſembling a nerve, that perforates the dura mater, and is fixed to the os coccygis.

The medulla ſpinalis gives riſe to thirty or thirty-one pair of nerves, but they are not all of the ſame ſize, nor do they all run in the ſame direction. The upper ones are thinner than the reſt, and are placed almoſt tranſverſely: as we deſcend we find them running more and more obliquely downwards, till at length their courſe is almoſt perpendicular, ſo that the lowermoſt nerves exhibit an appearance that is called *cauda equina*, from its reſemblance to a horſe's tail.

The arteries that ramify through the different parts of the brain, are derived from the internal carotid and from the vertebral arteries. The medulla ſpinalis is ſupplied by the anterior and poſterior ſpinal arteries, and likewiſe receives branches from the cervical, the inferior and ſuperior intercoſtal, the lumbar, and the ſacral arteries.

## *Of the Nerves.*

The *nerves* are medullary chords, differing from each other in ſize, colour, and conſiſtence, and deriving their origin from the medulla oblongata, and medulla ſpinalis.—There are thirty-nine, and ſometimes forty pair of theſe nerves; nine (*a*) of which originate from the medulla oblongata, and thirty or thirty-one from the medulla ſpinalis. They appear to be perfectly inelaſtic, and likewiſe to poſſeſs no irritability. If we irritate muſcular fibres, they immediately contract, but nothing of this ſort happens if we irritate a nerve. They carry with them a covering from the pia mater, but derive no tunic from the dura mater, as hath been generally, though erroneouſly ſuppoſed, ever ſince the time of Galen (*b*), the outer covering of the nerves being in fact nothing more than cellular membrane. This covering is very thick where the nerve

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(*a*) It has been uſual to deſcribe ten pair of nerves, as ariſing from the medulla oblongâta; but as the tenth pair ariſe in the ſame manner as the other ſpinal nerves, Santorini, Heiſter, Haller, and others, ſeem very properly to have claſſed them among the nerves of the ſpine.

(*b*) Baron Haller and profeſſor Zinn ſeem to have been the firſt who demonſtrated, that the dura mater is reflected upon, and adheres to the perioſteum at the edges of the foramina that afford a paſſage to the nerves out of the cranium, and vertebral canal, or is ſoon loſt in the cellular ſubſtance.

is expoſed to the action of muſcles, but where it runs through a bony canal, or is ſecure from preſſure, the cellular tunic is extremely thin, or altogether wanting. We have inſtances of this in the *portio mollis* of the auditory nerve, and in the nerves of the heart.

By elevating, carefully and gently, the brain from the baſis of the cranium, we find the firſt nine pair ariſing in the following order: 1. The *nervi olfactorii*, diſtributed through the pituitary membrane, which conſtitutes the organ of ſmell. 2. The *optici*, which go to the eyes, where they receive the impreſſions of viſible objects. 3. The *oculorum motores*, ſo called, becauſe they are diſtributed to the muſcles of the eye. 4. The *pathetici*, diſtributed to the ſuperior oblique muſcles of the eyes, the motion of which is expreſſive of certain paſſions of the ſoul. 5. The nerves of this pair ſoon divide into three principal branches, and each of theſe has a different name. Its upper diviſion is the *opthalamicus*, which is diſtributed to various parts of the eyes, eye-lids, fore-head, noſe, and integuments of the face. The ſecond is called the *maxillaris ſuperior*, and the third, *maxillaris inferior*, both which names allude to their diſtribution. 6. The *abductores*; each of theſe nerves is diſtributed to the abductor muſcle of the eye, ſo called, becauſe it helps to draw the globe of the eye from the noſe. 7. The *auditorii* (*c*), which are diſtributed through the organs of hearing. 8. The *par vagum*, which derives its name from the great number of parts, to which it gives branches both in the thorax and abdomen. 9. The *linguales* or *hypogloſſi*, which are diſtributed to the tongue, and appear to contribute both to the organ of taſte, and to the motions of the tongue (*d*).

It has already been obſerved, that the ſpinal marrow ſends off thirty or thirty-one pair

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(*c*) This pair, ſoon after its entrance into the meatus auditorius internus, ſeparates into two branches. One of theſe is of a very ſoft and pulpy conſiſtence, is called the *portio mollis* of the ſeventh pair, and is ſpread over the inner part of the ear.—The other paſſes out through the aquæduct of Fallopius in a firm chord, which is diſtinguiſhed as the *portio dura*, and is diſtributed to the external ear, and other parts of the neck and face.

(*d*) Heiſter has ſummed up the uſes of theſe nine pair of nerves in the two following Latin verſes:

"Olfaciens, cernens, oculoſque movens, patienſque,
"Guſtans, abducens, audienſque, vaganſque, loquenſ-
"que."

of nerves; theſe are chiefly diſtributed to the exterior parts of the trunk, and to the extremities.—They are commonly diſtinguiſhed into the *cervical*, *dorſal*, *lumbar*, and *ſacral nerves*. The cervical, which paſs out from between the ſeveral vertebræ of the neck, are eight (*e*) in number; the *dorſal*, twelve; the *lumbar*, five; and the *ſacral*, five or ſix; the number of the latter depending on the number of holes in the os ſacrum. Each ſpinal nerve at its origin, is compoſed of two faſciculi of medullary fibres. One of theſe faſciculi ariſes from the

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(*e*) Beſides theſe, there is another pair called *acceſſorii*, which ariſes from the medulla ſpinalis at its beginning, and aſcending through the great foramen of the os occipitis into the cranium, paſſes out again cloſe to the eighth pair, with which, however, it does not unite; and it is afterwards diſtributed chiefly to the muſcles of the neck, back and ſcapula.—In this courſe it ſends off filaments to different parts, and likewiſe communicates with ſeveral other nerves.—Phyſiologiſts are at a loſs how to account for the ſingular origin and courſe of theſe nervi acceſſorii. The ancients conſidered them as branches of the eighth pair, diſtributed to muſcles of the ſcapula: Willis likewiſe conſidered them as appendages to that pair, and on that account named them *acceſſorii*. They are ſometimes called the *ſpinal* pair; but as this latter name is applicable to all the nerves of the ſpine indiſcriminately, it ſeems better to adopt that given by Willis.

the anterior, and the other from the poſterior ſurface of the medulla. Theſe faſciculi are ſeparated by the ligamentum denticulatum, after which we find them contiguous to one another. They then perforate the dura mater, and unite to form a conſiderable knot or ganglion. Each of theſe ganglions ſends off two branches, one anterior, and the other poſterior. The anterior branches communicate with each other at their coming out of the ſpine, and likewiſe ſend off one, and ſometimes more branches, to aſſiſt in the formation of the intercoſtal nerve.

The knots or ganglions of the nerves juſt now ſpoken of, are not only to be met with at their exit from the ſpine, but likewiſe in various parts of the body. They occur in the nerves of the medulla oblongata, as well as in thoſe of the ſpine. They are not the effects of diſeaſe, but are to be met with in the ſame parts of the ſame nerves, both in the fœtus and adult. They are commonly of an oblong ſhape, and of a greyiſh colour, ſomewhat inclined to red, which is perhaps owing to their being extremely vaſcular. Internally we are able to diſtinguiſh ſomething like an intermixture of the nervous filaments.

Some writers have conſidered them as ſo many little brains; Lanciſi fancied he had diſcovered muſcular fibres in them, but they are certainly not of an irritable nature; a late writer, Dr. Johnſtone (*f*), imagines they are intended to deprive us of the power of the will over certain parts, as the heart, for inſtance; but if this hypotheſis were well founded, we ſhould meet with them only in nerves leading to involuntary muſcles; whereas it is certain, that the voluntary muſcles receive their nerves through ganglions. Other theories have been formed concerning them, none of which, however, have as yet led to aſcertain their uſe.

The nerves, like the blood-veſſels, in their courſe through the body, communicate with each other, and each of theſe communications conſtitutes what is called a *plexus*, from whence branches are again detached to different parts of the body. Some of theſe are conſtant and conſiderable enough to be diſtinguiſhed by par-

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(*f*) An Eſſay on the Uſe of the Ganglions of the Nerves.

ticular names, as the *ſemilunar plexus*; the *pulmonary plexus*, the *hepatic*, the *cardiac*, &c.

It would be foreign to the purpoſe of this work, to follow the nerves through all their diſtributions; but it may be remembered, that in deſcribing the different viſcera, mention was made of the nerves diſtributed to them. There is one pair, however, called the *intercoſtal* or *great ſympathetic nerve*, which ſeems to require particular notice, becauſe it has an almoſt univerſal connection and correſpondence with all the other nerves of the body.—Authors are not perfectly agreed about the origin of the *intercoſtal*; but it may perhaps not improperly be deſcribed, as beginning from filaments of the fifth and ſixth pair; it then paſſes out of the cranium, through the bony canal of the carotid, from whence it deſcends laterally cloſe to the bodies of the vertebræ, and receives branches from almoſt all the vertebral nerves; forming almoſt as many *ganglions* in its courſe through the thorax and abdomen. It ſends off an infinite number of branches to the viſcera in thoſe cavities, and forms ſeveral *plexus* with the branches of the eighth pair, or par vagum.

THAT the nerves are deſtined to convey the principles of motion and ſenſibility to the brain from all parts of the ſyſtem, there can be no doubt; but how theſe effects are produced, no one has ever yet been able to determine. The enquiry has been a conſtant ſource of hypotheſis in all ages, and has produced ſome ingenious ideas, and many erroneous poſitions, but without having hitherto afforded much ſatiſfactory information.

SOME phyſiologiſts have conſidered a trunk of nerves as a ſolid chord, capable of being divided into an infinite number of filaments, by means of which the impreſſions of feeling are conveyed to the ſenſorium commune.—Others have ſuppoſed to be a canal, which afterwards ſeparates into more minute channels; or, perhaps, as being an aſſemblage of many very ſmall and diſtinct tubes, connected to each other, and thus forming a cylindrical chord. They who contend for their being ſolid bodies, are of opinion, that feeling is occaſioned by vibration; ſo that, for inſtance, according to this ſyſtem, by pricking the finger, a vibration would be occaſioned in the nerve, diſtributed through its ſubſtance, and the effects of this vibration, when extended to the ſenſorium, would be an excital of pain. But the inelaſticity, the ſoftneſs, the connection, and the ſituation of the nerves, are ſo many proofs, that vibration has no ſhare in the cauſe of feeling.

Others have ſuppoſed that in the brain and ſpinal marrow, a very ſubtile fluid is ſecreted, and from thence conveyed through the imperceptible tubes, which they conſider as exiſting in the nerves.—They have farther ſuppoſed, that this very ſubtile fluid, to which they have given the name of animal ſpirits, is ſecreted in the cortical ſubſtance of the brain and ſpinal marrow, from whence it paſſes through the medullary ſubſtance. This, like the other ſyſtem, is founded altogether on hypotheſis; but it ſeems to be an hypotheſis derived from much more probable principles, and there are many ingenious arguments to be brought in its ſupport.

# C H A P. VII.

## *Of the Senſes.*

IN treating of the ſenſes, we mean to confine ourſelves to the external ones of *touch*, *taſte*, *ſmelling*, *hearing*, and *viſion*. The word *ſenſe*, when applied to theſe five, ſeems to imply not only the ſenſation excited in the mind by certain impreſſions made on the body, but likewiſe the organ deſtined to receive and tranſmit theſe impreſſions to the ſenſorium.—Each of theſe organs being of a peculiar ſtructure, is ſuſceptible only of particular impreſſions, which will be pointed out as we proceed to deſcribe each of them ſeparately.

## SECTION I.

### *Of the Senſe of Touch.*

THE *ſenſe* of *touch* may be defined to be the faculty of diſtinguiſhing certain properties of bodies by the feel. In a general acceptation, this definition might perhaps not improperly be extended to every part of the body poſſeſſed of ſenſibility (*g*), but it is commonly confined to the nervous papillæ of the *cutis*, or true ſkin, which, with its appendages, and their ſeveral uſes, have been already deſcribed.

The exterior properties of bodies, ſuch as their ſolidity, moiſture, inequality, ſmooth-

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(*g*) In the courſe of this volume, mention has often been made of the ſenſibility or inſenſibility of different parts of the body; it will therefore, perhaps, not be amiſs to obſerve in this place, that many parts which were formerly ſuppoſed to poſſeſs the moſt exquiſite ſenſe, are now known to have but little or no feeling, at leaſt in a ſound ſtate; for in an inflamed ſtate, even the bones, the moſt inſenſible parts of any, become ſuſceptible of the moſt painful ſenſations. This curious diſcovery is due to the late Baron Haller. His experiments prove, that the bones, cartilages, ligaments, tendons, epidermis, and membranes, (as the pleura, pericardium, dura and pia mater, perioſteum, &c.) may in a healthy ſtate be conſidered as inſenſible. As ſenſibility depends on the brain and nerves, of courſe, different parts will poſſeſs a greater or leſs degree of feeling, in proportion as they are ſupplied with a greater or ſmaller number of nerves. Upon this principle it is, that the ſkin, muſcles, ſtomach, inteſtines, urinary bladder, ureters, uterus, vagina, penis, tongue, and retina, are extremely ſenſible, while the lungs and glands have only an obſcure degree of feeling.

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neſs, dryneſs, or fluidity, and likewiſe their degree of heat, ſeem all to be capable of making different impreſſions on the papillæ, and conſequently of exciting different ideas in the ſenſorium commune. But the organ of touch, like all the other ſenſes, is not equally delicate in every part of the body, or in every ſubject; being in ſome much more exquiſite than it is in others.

## SECTION II.

### *Of the Taſte.*

THE *ſenſe of taſte* is ſeated chiefly in the tongue, of the ſituation and ſtructure of which, ſome account has already been given in a former part (*h*) of the work.

ON the upper ſurface of this organ we may obſerve a great number of papillæ, which, on account of their difference in ſize and ſhape, are commonly divided into three claſſes. The largeſt are ſituated towards the baſis of the tongue. Their number commonly varies from

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(*h*) See page 215.

ſeven to nine, and they ſeem to be mucous follicles. Thoſe of the ſecond claſs are ſomewhat ſmaller, and of a cylindrical ſhape. They are moſt numerous about the middle of the tongue. Thoſe of the third claſs are very minute, and of a conical ſhape. They are very numerous on the apex and edges of the tongue, and have been ſuppoſed to be formed by the extremities of its nerves.

We obſerve a line, the *linea linguæ mediana*, running along the middle of the tongue, and dividing it as it were into two portions. Towards the baſis of the tongue, we meet with a little cavity, named by Morgagni, *foramen cæcum*, which ſeems to be nothing more than the excretory ducts of mucous glands ſituated within the ſubſtance of the tongue.

We have already obſerved, that this organ is every where covered by the cuticle, which, by forming a reduplication, called the *frænum*, at its under part, ſerves to prevent the too great motion of the tongue, and to fix it in its ſituation. But, beſides this attachment, the tongue is connected by means of its muſcles and membranous ligaments, to the lower jaw; the os hyoides and the ſtyloid proceſſes.

THE principal arteries of the tongue are the *linguales*, which ariſe from the external carotid. Its veins empty themſelves into the external jugulars. Its nerves ariſe from the fifth, eighth, and ninth pair.

THE variety of taſtes ſeems to be occaſioned by the different impreſſions made on the papillæ by the food. The different ſtate of the papillæ with reſpect to their moiſture, their figure, or their covering, ſeems to produce a conſiderable difference in the taſte, not only in different people, but in the ſame ſubject, in ſickneſs and in health. The great uſe of the taſte ſeems to be to enable us to diſtinguiſh wholeſome and ſalutary food from that which is unhealthy; and we obſerve that many quadrupeds, by having their papillæ (*i*) very large and long, have the faculty of diſtinguiſhing flavours with infinite accuracy.

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(*i*) Malpighi's deſcription of the papillæ, which has been copied by many anatomical writers, ſeems to have been taken chiefly from the tongues of ſheep.

## SECTION III.

### *Of Smelling.*

THE *ſenſe of ſmelling*, like the ſenſe of taſte, ſeems intended to direct us to a proper choice of aliment, and is chiefly ſeated in the noſe, which is diſtinguiſhed into its external and internal parts. The ſituation and figure of the former of theſe do not ſeem to require a definition. It is compoſed of bones and cartilages, covered by muſcular fibres, and by the common integuments. The bones make up the upper portion, and the cartilages the lower one. The *ſeptum narium*, like the noſe, is likewiſe in part bony, and in part cartilaginous. Theſe bones and their connections, were deſcribed in the oſteology.

THE *internal* part of the noſe, beſides the oſſa ſpongioſa, has ſix cavities or ſinuſes; the *maxillary*, the *frontal*, and the *ſphenoid*, which were all deſcribed with the bones of the head. They all open into the noſtrils, and the noſe likewiſe communicates with the mouth, larynx,

rynx, and pharynx, poſteriorly behind the velum palati.

All theſe ſeveral parts which are included in the internal diviſion of the noſe, *viz.* the inner ſurface of the noſtrils, the lamellæ of the oſſa ſpongioſa, and the ſinuſes, are lined by a thick and very vaſcular membrane, which, tho' not unknown to the ancients, was firſt well deſcribed by Schneider (*k*), and is therefore now commonly named *membrana pituitaria Schneideri.* This membrane is truly the organ of ſmelling, but its real ſtructure does not yet ſeem to be perfectly underſtood. It appears to be a continuation of the cuticle, which lines the inner ſurface of the mouth. In ſome parts of the noſe it is ſmooth and firm, and in others it is looſe and ſpongy It is conſtantly moiſtened by a mucous ſecretion, the finer parts of which are carried off by the air we breathe, and the remainder by being retained in the ſinuſes, acquires conſiderable conſiſtence. The manner in which this mucus is ſecreted has not yet been ſatisfactorily aſcertained, but it ſeems to be by means of mucous follicles.

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(*k*) De Catarrho, Lib. III.

Its arteries are branches of the internal maxillary and internal carotid. Its veins empty themſelves into the internal jugulars. The firſt pair of nerves; the *olfactory*, are ſpread over every part of it, and it likewiſe receives branches from the fifth pair.

After what has been ſaid of the pituitary membrane, it will not be difficult to conceive how the air we draw in at the noſtrils, being impregnated with the effluvia of bodies, excites in us that kind of ſenſation we call *ſmelling*. As theſe effluvia, from their being exceedingly light and volatile, cannot be capable in a ſmall quantity of making any great impreſſion on the extremities of the olfactory nerves, it was neceſſary to give conſiderable extent to the pituitary membrane, that by this means a greater number of odoriferous particles might be admitted at the ſame time. When we wiſh to take in much of the effluvia of any thing, we naturally cloſe the mouth, that all the air we inſpire, may paſs through the noſtrils; and at the ſame time, by means of the muſcles of the noſe, the noſtrils are dilated, and a greater quantity of air is drawn into them.

In many quadrupeds, the ſenſe of ſmelling is much more extenſive and delicate than it is in the human ſubject; and in the human ſubject, it ſeems to be more perfect, the leſs it is vitiated by a variety of ſmells.—It is not always in the ſame ſtate of perfection, being naturally affected by every change of the pituitary membrane, and of the lymph with which that membrane is moiſtened.

## SECTION IV.

### *Of Hearing.*

BEFORE we undertake to explain the manner in which we are enabled to receive the impreſſions of ſound, it will be neceſſary to deſcribe the *ear*, which is the *organ of hearing*. It is commonly diſtinguiſhed into external and internal. The former of theſe diviſions includes all that we are able to diſcover without diſſection, and the meatus auditorius, as far as the tympanum; and the latter, all the other parts of the ear.

The *external ear* is a cartilaginous funnel, covered by the common integuments, and attached,

tached, by means of its ligaments and muſcles, to the temporal bone. Although capable only of a very obſcure motion, it is found to have ſeveral muſcles.—Different parts of it are diſtinguiſhed by different names; all its cartilaginous part is called *ala* or *wing*, to diſtinguiſh it from the ſoft and pendent part below, called the *lobe*. Its outer circle or border is called *helix*, and the ſemicirle within this, *antihelix*. The moveable cartilage placed immediately before the meatus auditorius, which it may be made to cloſe exactly, is named *tragus*; and an eminence oppoſite to this at the extremity of the *antihelix*, is called *antitragus*. The *concha* is a conſiderable cavity formed by the extremities of the *helix* and *antihelix*.—The *meatus auditorius*, which at its opening is cartilaginous, is lined with a very thin membrane, which is a continuation of the cuticle, from the ſurface of the ear.

In this canal we find a yellow wax, which is ſecreted by a number of minute glands or follicles, each of which has an excretory duct. This ſecretion, which is at firſt of an oily conſiſtence, defends the membrane of the tympanum from the injuries of the air; and by its bitterneſs, prevents minute inſects from entering into the ear. But, when from neglect or diſeaſe, it accumulates in too great a quantity, it ſometimes occaſions deafneſs. The inner extremity of the meatus is cloſed by a very thin tranſparent membrane, the *membrana tympani*, which is ſet in a bony circle like the head of a drum.—In the laſt century, Rivinus, profeſſor at Leipſic, fancied he had diſcovered a hole in this membrane, ſurrounded by a ſphincter, and affording a paſſage to the air, between the external and internal ear. Cowper, Heiſter, and ſome other anatomiſts, have admitted this ſuppoſed foramen, which certainly does not exiſt. Whenever there is any opening in the membrana tympani, it may be conſidered as accidental.—Under the membrana tympani, runs a branch of the fifth pair of nerves, called *chorda tympani*; and beyond this membrane is the cavity of the tympanum, which is about ſeven or eight lines wide, and half ſo many in depth—it is ſemi-ſpherical, and every where lined by a very fine membrane. There are four openings to be obſerved in this cavity. It communicates with the mouth, by means of the *Euſtachian tube*. This canal, which is in part bony, and in part cartilaginous,

nous, begins by a very narrow opening at the anterior and almoſt ſuperior part of the tympanum, increaſing in ſizeas it advances towards the palate of the mouth, where it terminates by an oval opening. This tube is every where lined by the ſame membrane that covers the inſide of the mouth.—The real uſe of this canal, does not ſeem to have been hitherto ſatiſfactorily aſcertained; but ſound would ſeem to be conveyed through it to the membrana tympani, deaf perſons being often obſerved to liſten attentively with their mouths open. Oppoſite to this is a minute paſſage, which leads to the ſinuoſities of the maſtoid proceſs; and the two other openings, which are in the internal proceſs of the os petroſum, are the *feneſtra ovalis*, and *feneſtra rotunda*, both of which are covered by a very fine membrane.

There are three diſtinct bones in the cavity of the tympanum, and theſe are the *malleus*, *incus*, and *ſtapes*. Beſides theſe there is a fourth, which is the *os orbiculare*, conſidered by ſome anatomiſts, as a proceſs of the *ſtapes*, which is neceſſarily broken off by the violence we are obliged to uſe, in getting at theſe bones;

but when accurately conſidered, it ſeems to be a diſtinct bone.

The *malleus* is ſuppoſed to reſemble a *hammer*, being larger at one extremity, which is its *head*, than it is at the other, which is its *handle*. The latter is attached to the membrana tympani, and the head of the bone is articulated with the *incus*.

The *incus*, as it is called from its ſhape, though it ſeems to have leſs reſemblance to an *anvil*, than to one of the dentes molares with its roots widely ſeparated from each other, is diſtinguiſhed into its body and its legs. One of its legs is placed at the entry of the canal which leads to the maſtoid proceſs; and the other, which is ſomewhat longer, is articulated with the *ſtapes*, or rather with the *os orbiculare*, which is placed between them.

The third bone is very properly named *ſtapes*, being perfectly ſhaped like a ſtirrup.—Its baſis is fixed into the *feneſtra ovalis*, and its upper part is articulated with the *os orbiculare*. What is called the *feneſtra rotunda*, though perhaps improperly, as it is more oval than round, is obſerved a little above the other, in an eminence formed by the os petroſum, and is cloſed by a continuation of the membrane that lines the inner ſurface of the tympanum. The ſtapes and malleus are each of them furniſhed with a little muſcle, the *ſtapedeus* and *tenſor tympani*. The firſt of theſe, which is the ſmalleſt in the body, ariſes from a little cavern in the poſterior and upper part of the cavity of the tympanum; and its tendon, after paſſing through a hole in the ſame cavern, is inſerted at the back part of the head of the ſtapes. This muſcle, by drawing the ſtapes obliquely upwards, aſſiſts in ſtretching the membrana tympani.

The *tenſor tympani* (*l*) or *internus mallei*, as it is called by ſome writers, ariſes from the cartilaginous extremity of the Euſtachian tube, and is inſerted into the back part of the handle of the malleus, which it ſerves to pull inwards, and

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(*l*) Some anatomiſts deſcribe three muſcles of the malleus, but only this one ſeems to deſerve the name of muſcle, what are called the *externus*, and *obliquus mollei*, ſeeming to be ligaments, rather than muſcles.

of courſe helps to ſtretch the membrana tympani.

The *labyrinth*, is the only part of the ear which remains to be deſcribed. It is ſituated in the os petroſum, and is ſeparated from the tympanum by a partition which is every where bony, except at the two feneſtræ.—It is compoſed of three parts; and theſe are the *veſtibulum*, the *ſemi-circular canals*, and the *cochlea.*

The *veſtibulum* is an irregular cavity, much ſmaller than the tympanum, ſituated nearly in the center of the os petroſum, between the tympanum, the cochlea, and the ſemi-circular canals. It is open on the ſide of the tympanum, by means of the feneſtra ovalis, and communicates with the upper portion of the cochlea by an oblong foramen, which is under the feneſtra ovalis, from which it is ſeparated only by a very thin partition.

Each of the three *ſemi-circular canals*, forms about half a circle of nearly a line in diameter, and running each in a different direction, they are diſtinguiſhed into *vertical*, *oblique*, and *horizontal.* Theſe three canals open by both their extremities into the veſtibulum; but the *vertical* and the *oblique*, being united together at one of their extremities, there are only five orifices to be ſeen in the veſtibulum.

THE *cochlea* is a canal which takes a ſpiral courſe, not unlike the ſhell of a ſnail. From its baſis to its apex it makes two turns and a half, and is divided into two canals by a very thin lamina or ſeptum, which is in part bony, and in part membranous, in ſuch a manner, that theſe two canals only communicate with each other at the point. One of them opens into the veſtibulum, and the other is covered by the membrane that cloſes the *feneſtra rotunda*. The bony lamella which ſeparates the two canals, is exceedingly thin, and fills about two thirds of the diameter of the canal. The reſt of the ſeptum is compoſed of a moſt delicate membrane, which lines the whole inner ſurface of the cochlea, and ſeems to form this diviſion in the ſame manner as the two membranous bags of the pleura, by being applied to each other, form the mediaſtinum.

EVERY part of the labyrinth is furniſhed with a very delicate perioſteum, and filled with a watery fluid, ſecreted as in other cavities. This fluid tranſmits to the nerves the vibrations it receives from the membrane cloſing the feneſtra rotunda, and from the baſis of the ſtapes, where it reſts on the feneſtrum ovale. When this fluid is collected in too great a quantity, or is compreſſed by the ſtapes, it eſcapes through two minute canals or *aquæducts*, lately deſcribed by Dr. Cotunni (*m*), an ingenious phyſician at Naples. One of theſe aquæducts opens into the bottom of the veſtibulum, and the other into the cochlea, near the feneſtra rotunda. They both paſs through the os petroſum, and communicate with the cavity of the cranium, where the fluid that paſſes through them is abſorbed; and they are lined by a membrane, which is ſuppoſed to be a production of the dura mater.

The arteries of the external ear come from the temporal and other branches of the external carotid, and its veins paſs into the jugular.—The internal ear receives branches of arteries from the baſilary and carotids, and its veins empty

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(*m*) De Aqueductibus Auris Humanæ Internæ, 8vo. Neapol, 1760.

themſelves into the ſinuſes of the dura mater, and into the internal jugular.

The *portio mollis* of the ſeventh pair is diſtributed through the *cochlea*, the *veſtibulum*, and the *ſemi-circular canals*; and the *portio dura* ſends off a branch to the tympanum, and other branches to the external ear and parts near it.

The *ſenſe of hearing*, in producing which all the parts we have deſcribed aſſiſt, is occaſioned by a certain modulation of the air collected by the funnel-like ſhape of the external ear, and conveyed through the meatus auditorius to the membrana tympani. That ſound is propagated by means of the air, is very eaſily proved by ringing a bell under the receiver of an air-pump; the ſound it affords being found to diminiſh gradually as the air becomes exhauſted, till at length it ceaſes to be heard at all. Sound moves through the air with infinite velocity, but the degree of its motion ſeems to depend on the ſtate of the air, as it conſtantly moves faſter in a denſe and dry, than it does in a moiſt and rarefied air.

THAT the air vibrating on the membrana tympani, communicates its vibration to the different parts of the labyrinth, and by means of the fluid contained in this cavity, affects the auditory nerve ſo as to produce ſound; ſeems to be very probable; but the ſituation, the minuteneſs, and the variety of the parts which compoſe the ear, do not permit much to be advanced with certainty, concerning their mode of action.

SOME of theſe parts ſeem to conſtitute the immediate organ of hearing, and theſe are all the parts of the *veſtibulum:* but there are others which ſeem intended for the perfection of this ſenſe, without being abſolutely eſſential to it. It has happened for inſtance, that the membrana tympani, and the little bones of the ear, have been deſtroyed by diſeaſe, without depriving the patient of the ſenſe of hearing (*n*).

(*n*) This obſervation has led to a ſuppoſition, that a perforation of this membrane, may, in ſome caſes of deafneſs, be uſeful; and Mr. Cheſelden relates, that ſome years ago, a malefactor was pardoned, on condition that he ſhould ſubmit to this operation; but the public clamour raiſed againſt it was ſo great, that it was thought right not to perform it.

Sound is more or leſs loud, in proportion to the ſtrength of the vibration; and the variety of ſounds ſeems to depend on the difference of this vibration; for the more quick and frequent it is, the more acute will be the ſound, and *vice verſa*.

Before we conclude this article, it will be right to explain certain phenomena, which will be found to have a relation to the organ of hearing.

Every body has, in conſequence of particular ſounds, occaſionally felt that diſagreeable ſenſation which is uſually called, *ſetting the teeth on edge*; and the cauſe of this ſenſation may be traced to the communication which the portio dura of the auditory nerve has with the branches of the fifth pair, that are diſtributed to the teeth, being probably occaſioned by the violent tremor produced in the membrana tympani, by theſe very acute ſounds. Upon the ſame principle we may explain the ſtrong idea of ſound which a perſon has who holds a vibrating ſtring between his teeth.

The humming which is ſometimes perceived in the ear, without any exterior cauſe, may be occaſioned either by an increaſed action of the arteries in the ears, or by convulſive contractions of the muſcles of the malleus and ſtapeus, affecting the auditory nerve in ſuch a manner as to produce the idea of ſound. An ingenious philoſophical writer (*o*) has lately diſcovered, that there are ſounds liable to be excited in the ear by irritation, and without any aſſiſtance from the vibrations of the air.

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(*o*) *See* Elliot's *Philoſophical Obſervations, on the Senſes of Viſion and Hearing*, 8vo.

## SECTION V.

### *Of Viſion.*

THE *eyes*, which conſtitute the *organ of viſion*, are ſituated in two bony cavities, named *orbits*, where they are ſurrounded by ſeveral parts, which are either intended to protect them from external injury, or to aſſiſt in their motion.

THE globe of the eye is immediately covered by two *eye-lids* or *palpebræ*, which are compoſed of muſcular fibres (*p*) covered by the common integuments, and lined by a very fine and ſmooth membrane, which is from thence extended over part of the globe of the eye, and is called *tunica conjunctiva*. Each eye-lid is cartilaginous at its edge, and this border, which is called *tarſus*, is furniſhed with a row of hairs, named *cilia* or *eye-laſhes*.

THE *cilia* ſerve to protect the eye from inſects and minute bodies floating in the air, and

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(*p*) *See* page 136.

likewiſe to moderate the action of the rays of light in their paſſage to the retina. At the roots of theſe hairs there are ſebaceous follicles, firſt noticed by *Meibomius*, which diſcharge a glutinous liniment. Sometimes the fluid they ſecrete has too much viſcidity, and the eye-lids become glued to each other.

THE upper border of the orbit is covered by the *eye-brows* or *ſupercilia*, which by means of their two muſcles are capable of being brought towards each other, or of being carried upwards.—They have been conſidered as ſerving to protect the eyes, but they are probably intended more for ornament than utility (*q*).

THE orbits, in which the eyes are placed, are furniſhed with a good deal of fat, which affords a ſoft bed on which the eye performs its ſeveral motions.—The inner angle of each orbit, or that part of it which is near the noſe, is called *canthus major* or the *great angle*; and the outer angle, which is on the oppoſite ſide of the eye, is the *canthus minor* or *little angle*.

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(*q*) It is obſervable, that the eye-brows are peculiar to the human ſpecies.

The little reddiſh body which we obſerve in the great angle of the eye-lids, and which is called *caruncula lachrymalis*, is ſuppoſed to be of a glandular ſtructure, and like the follicles of the eye-lids, to ſecrete an oily humour. But its ſtructure and uſe, do not ſeem to have been hitherto accurately determined. The ſurface of the eye, is conſtantly moiſtened by a very fine limpid fluid called the *tears*, which is chiefly, and perhaps wholly derived from a large gland of the conglomerate kind, ſituated in a ſmall depreſſion of the os frontis near the outer angle of the eye. Its excretory ducts pierce the *tunica conjunctiva*, juſt above the cartilaginous borders of the upper eye-lids. When the tears were ſuppoſed to be ſecreted by the caruncule, this gland was called *glandula innominata*; but now that its ſtructure and uſes are aſcertained, it very properly has the name of *glandula lachrymalis*. The tears poured out by the ducts of this gland are in a natural and healthy ſtate, inceſſantly ſpread over the ſurface of the eye, to keep it clear and tranſparent, by means of the eye-lids, and as conſtantly paſs out at the oppoſite corner of the eye or inner angle, through two minute orifices, ſices, the *punćta lachrymalia* (*r*); being determined into theſe little openings by a reduplication of the tunica conjunćtiva, ſhaped like a creſcent, the two points of which anſwer to the *punćta*. This reduplication is named *membrana*, or *valvula ſemilunaris*. Each of theſe *punćta* is the beginning of a ſmall excretory tube, through which the tears paſs into a little pouch or reſervoir, the *ſacculus lachrymalis*, which lies in an excavation formed partly by the naſal proceſs of the os maxillare ſuperius, and partly by the os unguis. The lower part of this ſac forms a dućt, called the *dućtus ad nares*, which is continued through a bony channel, and opens into the noſe, through which the tears are occaſionally diſcharged (*s*).

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(*r*) It ſometimes happens, that this very pellucid fluid which moiſtens the eye, being poured out through the excretory dućts of the lachrymal gland, faſter than it can be carried off through the punćta, trickles down the cheek, and is then ſtrićtly and properly called *tears*.

(*s*) When the dućtus ad nares becomes obſtrućted, in conſequence of diſeaſe, the tears are no longer able to paſs into the noſtrils, the ſacculus lachrymalis becomes diſtended, and inflammation, and ſometimes ulceration taking place, conſtitute the diſeaſe called *fiſtula lachrymalis*.

The motions of the eye are performed by ſix muſcles; four of which are *ſtraight* and two *oblique*. The *ſtraight* muſcles are diſtinguiſhed by the names of *elevator*, *depreſſor*, *adductor*, and *abductor*, from their ſeveral uſes in elevating and depreſſing the eye, drawing it towards the noſe, or carrying it from the noſe towards the temple. All theſe four muſcles ariſe from the bottom of the orbit, and are inſerted by flat tendons into the globe of the eye. The *oblique* muſcles are intended for the more compound motions of the eye. The firſt of theſe muſcles, the *obliquus ſuperior*, does not, like the other four muſcles we have deſcribed, ariſe from the bottom of the orbit, but from the edge of the foramen that tranſmits the optic nerve, which ſeparates the origin of this muſcle from that of the others. From this beginning it paſſes in a ſtraight line towards a very ſmall cartilaginous ring, the ſituation of which is marked in the ſkeleton by a little hollow in the internal orbitar proceſs of the os frontis. The tendon of the muſcle after paſſing through this ring, is inſerted into the upper part of the globe of the eye, which it ſerves to draw forwards, at the ſame time turning the pupil downwards.

THE *obliquus inferior* ariſes from the edge of the orbit, under the opening of the ductus lachrymalis, and is inſerted ſomewhat poſteriorly into the outer ſide of the globe, ſerving to draw the eye forwards and turn the pupil upwards. When either of theſe two muſcles acts ſeparately, the eye is moved on its axis; but when they act together, it is compreſſed both above and below.—The eye itſelf, which is now to be deſcribed with its tunics, humours, and component parts, is nearly of a ſpherical figure. Of its tunics, the *conjunctiva* has been already deſcribed as a partial covering, reflected from the inner ſurface of the eye-lids over the anterior portion of the eye. What has been named *albuginea*, cannot properly be conſidered as a coat of the eye, being in fact nothing more than the tendons of the ſtraight muſcles ſpread over ſome parts of the ſclerotica.

THE immediate tunics of the eye, which are to be demonſtrated when its partial coverings and all the other parts with which it is ſurrounded are removed, are the *ſclerotica*, *choroides* and *retina*.

The *ſclerotica*, which is the exterior coat, is every where white and opaque, except at its anterior part, where it has more convexity than any other part of the globe, and being exceedingly tranſparent, is called *cornea* (*t*).— Theſe two parts are perfectly different in their ſtructure, ſo that ſome anatomiſts ſuppoſe them to be as diſtinct from each other, as the glaſs of a watch is from the caſe into which it is fixed. The ſclerotica is of a compact, fibrous ſtructure; the cornea, on the other hand, is compoſed of a great number of laminæ united by cellular membrane. By macerating them in boiling water, they do not ſeparate from each other as ſome writers have aſſerted, but the cornea ſoon ſoftens, and becomes of a glutinous conſiſtence.

The ancients ſuppoſed the ſclerotica to be a continuation of the dura mater. Morgagni and ſome other modern writers are of the ſame opinion, but this point is diſputed by Winſlow, Haller, Zinn, and others. The truth

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(*t*) Some writers who have given the name of *cornea* to all this outer coat, have named what is here, and moſt commonly called *ſclerotica, cornea opaca*; and its anterior and tranſparent portion, *cornea lucida*.

ſeems to be, that the ſclerotica, though not a production of the dura mater, adheres intimately to that membrane.

THE *choroides* is ſo called, becauſe it is furniſhed with a great number of veſſels. It has likewiſe been named *uvea*, on account of its reſemblance to a grape. Many modern anatomical writers, have conſidered it as a production of the pia mater. This was likewiſe the opinion of the ancients; but the ſtrength and thickneſs of the choroides when compared with the delicate ſtructure of the pia mater, are ſufficient proofs of their being two diſtinct membranes.

THE choroides has of late generally been deſcribed as conſiſting of two laminæ, the innermoſt of which has been named after Ruyſch, who firſt deſcribed it. It is certain, however, that Ruyſch's diſtinction is ill founded, at leaſt with reſpect to the human eye, in which we are unable to demonſtrate any ſuch ſtructure, although the tunica choroides of ſheep and ſome other quadrupeds, may eaſily be ſeparated into two layers.

The choroides adheres intimately to the ſclerotica, round the edge of the cornea, and at the place of this union we may obſerve a little whitiſh areola, named *ligamentum ciliare*, though it is not of a ligamentous nature.

They who ſuppoſe the choroides to be compoſed of two laminæ, deſcribe the external one as terminating in the ligamentum ciliare, and the internal one as extending farther to form the *iris*, which is the circle we are able to diſtinguiſh through the cornea; but this part is of a very different ſtructure from the choroides, ſo that ſome late writers have perhaps not improperly conſidered the iris as a diſtinct membrane. It derives its name from the variety of its colours, and is perforated in its middle. This perforation, which is called the pupil or ſight of the eye, is cloſed in the fœtus by a very thin vaſcular membrane. This *membrana pupillaris* commonly diſappears about the ſeventh month.

On the under ſide of the iris we obſerve many minute fibres, called *ciliary proceſſes*, which paſs in *radii* or parallel lines, from the circumference to the centre. The contraction and dilatation of the pupil are ſuppoſed to depend on the action of theſe proceſſes. Some have conſidered them as muſcular, but they are not of an irritable nature; others have ſuppoſed them to be filaments of nerves; but their real ſtructure has never yet been clearly aſcertained.

BESIDES theſe ciliary proceſſes, anatomiſts uſually ſpeak of the circular fibres of the iris, but no ſuch ſeem to exiſt.

THE poſterior ſurface of the iris, the ciliary proceſſes, and part of the tunica choroides, are covered by a black mucus for the purpoſes of accurate and diſtinct viſion; but the manner in which it is ſecreted, has not been determined.

IMMEDIATELY under the tunica choroides we find the third and inner coat, called the *retina*, which ſeems to be merely an expanſion of the pulpy ſubſtance of the optic nerve, extending to the borders of the cryſtalline humour.

THE greateſt part of the globe of the eye, within theſe ſeveral tunics, is filled by a very tranſparent and gelatinous humour of conſiderable conſiſtence, which, from its ſuppoſed reſemblance to fuſed glaſs, is called the *vitreous humour*. It is inveſted by a very fine and delicate membrane, called *tunica vitrea*, and ſometimes *arachnoides*.—It is ſuppoſed to be compoſed of two laminæ, one of which dips into its ſubſtance, and by dividing the humour into cells, adds to its firmneſs. The fore-part of the vitreous humour is a little hollowed, to receive a very white and tranſparent ſubſtance of a firm texture, and of a lenticular and ſomewhat convex ſhape, named the *cryſtalline humour*. It is included in a *capſula*, which ſeems to be formed by a ſeparation of the two laminæ of the *tunica vitrea*.

THE fore-part of the eye is filled by a very thin and tranſparent fluid, named the *aqueous humour*, which occupies all the ſpace between the cryſtalline and the prominent cornea.—That part of the choroides which is called the iris, and which comes forward to form the pupil, appears to be ſuſpended as it were in this humour, and has occaſioned this portion of the eye to be diſtinguiſhed into two parts. One of theſe, which is the little ſpace between the anterior ſurface of the cryſtalline and the iris, is called the *poſterior chamber*; and the other, which is the ſpace between the iris and the cornea, is called the *anterior chamber* of the eye (*u*).—Both theſe ſpaces are completely filled with the aqueous humour (*x*).

The eye receives its arteries from the internal carotid, and its veins empty themſelves chiefly into the external jugulars. Some of the ramifications of theſe veſſels appear on the inner ſurface of the iris, where they are ſeen to make very minute convolutions, which are

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(*u*) I am aware that ſome anatomiſts, particularly Lieutaud, are of opinion, that the iris is every where in cloſe contact with the cryſtalline, and that it is of courſe right to ſpeak only of one chamber of the eye—but as this does not appear to be the caſe, the ſituation of the iris and the two chambers of the eye are here deſcribed in the uſual way.

(*x*) When the cryſtalline becomes opaque, ſo as to prevent the paſſage of the rays of light to the retina, it conſtitutes what is called a *cataract*; and the operation of couching, conſiſts in removing the diſeaſed cryſtalline from its bed in the vitreous humour—In this operation the cornea is perforated, and the aqueous humour eſcapes out of the eye, but it is conſtantly renewed again in a very ſhort time. The manner however in which it is ſecreted, has not yet been determined.

ſufficiently remarkable to be diſtinguiſhed by the name of *circulus anterioſus*, though perhaps improperly, as they are chiefly branches of veins.

THE optic nerve paſſes in at the poſterior part of the eye, in a conſiderable trunk, to be expanded for the purpoſes of viſion, of which it is now univerſally ſuppoſed to be the immediate ſeat. But Meſſrs. Mariotte and Mery contended, that the choroides is the ſeat of this ſenſe; and the ancients ſuppoſed the cryſtalline to be ſo.—Beſides the optic, the eye receives branches from the third, fourth, fifth, and ſixth pair of nerves.

THE humours of the eye, together with the cornea, are calculated to refract and converge the rays of light in ſuch a manner, as to form at the bottom of the eye a diſtinct image of the object we look at; and the point where theſe rays meet, is called the *focus* of the eye. —On the retina, as in a *camera obſcura*, the object is painted in an inverted poſition; and it is only by habit that we are enabled to judge of its true ſituation, and likewiſe of its diſtance and magnitude. To a young gentleman,

man, who was born blind, and who was couched by Mr. Cheſelden, every object, (as he expreſſed himſelf) ſeemed to touch his eyes, as what he felt did his ſkin; and he thought no objects ſo agreeable as thoſe which were ſmooth and regular, although for ſome time he could form no judgment of their ſhape, or gueſs what it was in any of them that was pleaſing to him.

In order to paint objects diſtinctly on the retina, the cornea is required to have ſuch a degree of convexity, that the rays of light may be collected at a certain point ſo as to terminate exactly on the retina.—If the cornea is too prominent, the rays, by diverging too ſoon, will be united before they reach the retina, as is the caſe with near-ſighted people or *Myopes*; and on the contrary, if it is not ſufficiently convex, the rays will not be perfectly united when they reach the back part of the eye; and this happens to long-ſighted people or *Preſbi*, being found conſtantly to take place as we approach to old age, when the eye gradually flattens (*y*).—Theſe defects are to be ſupplied

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(*y*) Upon this principle they who in their youth are near-ſighted may expect to ſee better as they advance in life, and their eyes gradually become more flat.

by means of glaſſes—He who has too prominent an eye, will find his viſion improved by means of a concave glaſs, and upon the ſame principles, a convex glaſs will be found uſeful to a perſon whoſe eye is naturally too flat.

THE END.

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## ERRATA.

P. 144, laſt line, *for* callls, *read* calls.
146, 5th line from the bottom, *for* uſed, *read* uſe.
—— 4th - - - - - - ſtylo-hoideus, *read* ſtylo-hyoideus.
150, 3d - - - - - - - ptery-pharyngæus, *r.* pterygo-pharyngæus.
158, 5th - - - - - - Boyle, *read* Bayle
159, 4th - - - - - - from, *read* form
163, 4th - - - … - - faſcculi, *read* faſciculi.
164, 5th - - - - - - ayer, *read* layer.
182, in the note, *for* Spigalius, *read* Spigelius.
279, 8th line from the top, *for* glandular, *read* cellular.

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